

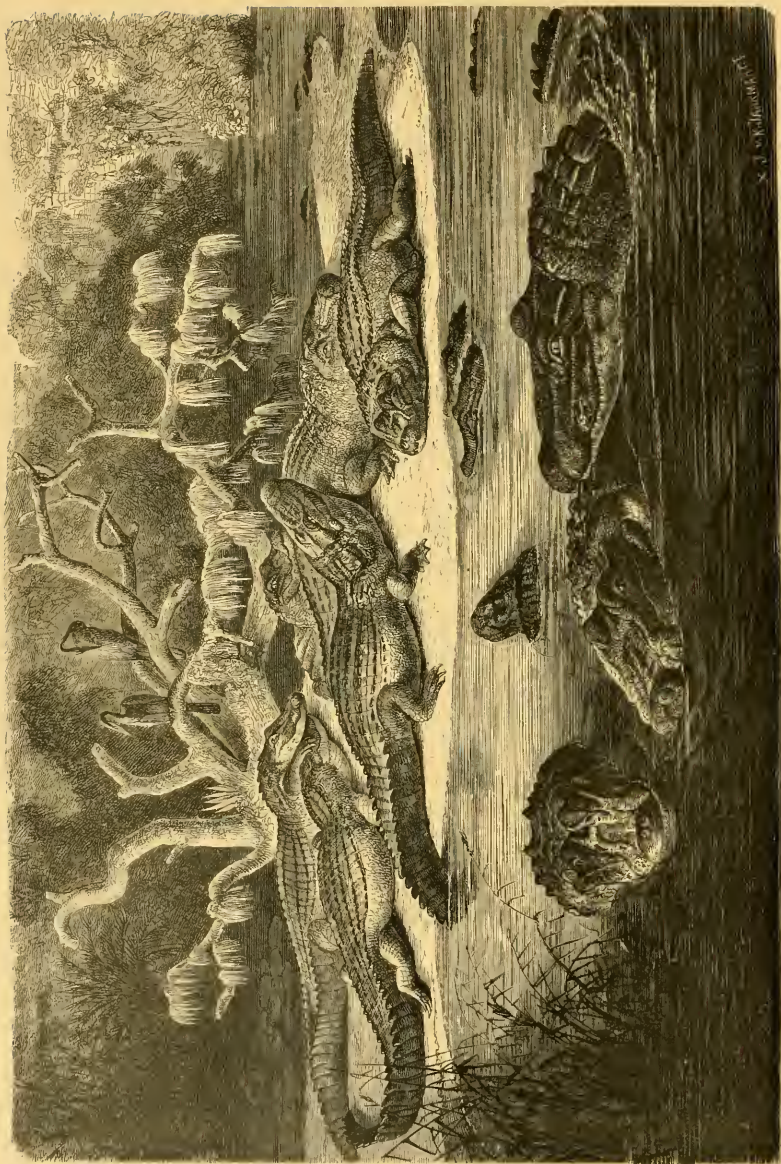
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REPTILIA



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Ernest Ingersoll
Museum of Comparative Zoology
Harvard University



Jacare nigra, black caiman.

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REPTILIA

WRITTEN FOR THE
STANDARD NATURAL HISTORY,

BY

HERMON CAREY BUMPUS,

ASSISTANT IN THE ZOOLOGICAL LABORATORY OF BROWN UNIVERSITY.

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CLASS VIII.—REPTILIA.

Reptiles are cold-blooded animals which breathe by means of lungs, and generally have the ventricles of the heart but incompletely separated from each other. The body is protected, externally, by scales or armor plates, and the embryos are provided with an amnion and an allantois. A general structure is presented somewhat higher than that of batrachians, and lower than, though strongly resembling, that of birds.

The general form of the body is that of the previous class. The trunk usually plays the chief part in locomotion, while the limbs are either entirely absent, as in Ophidia, or, among the lower forms, are present only as aids in the serpentine movement. To this end the vertebral column is strong and rigid, terminating posteriorly in an elongated tail, and presenting but feebly those regions so distinct in the birds and mammals. All reptiles, however, are not of this low type; the tortoises, several lizards, and many fossil forms have the limbs well developed and the vertebral column more or less differentiated.

Protection from injury with most of the smaller reptiles lies chiefly in resemblance, color, and in the shielded areas of the skin, the outgrowths of which may be from either the dermis proper, as the scale-like ossifications of many lizards, or from the epidermis, as the corneous plates of the crocodiles and turtles. Many serpents and the remarkable lizard *Heloderma* are provided with poison apparatus, which renders a conflict with them of the most dangerous nature. The larger reptiles trust alone to sheer force for protection.

The skeleton is seldom otherwise than strong and bony, and though many fossil forms, as well as the geckos and *Hatteria*, have bi-concave vertebral centra, as a rule the bodies of the vertebræ are concave anteriorly only. Ribs are quite characteristic,—in the serpents being the chief organs of locomotion, and in a few lizards forming the support of the so-called wings. They are often united to a sternum by means of sterno-costal pieces, and in the crocodiles a cartilaginous plate extends from sternum to pelvis, bearing lateral processes which serve the function of ribs proper. The skull is composed of well-ossified bones, the embryonic condition presented by many batrachians being supplanted, and is connected with the axial skeleton by means of a single condyle. The specialized cranial structure presented by the Ophidians is of particular interest, and will be spoken of in connection with that group. The limbs and their respective girdles, though completely absent in most snakes, are generally present and are often highly specialized.

The nervous system is a decided advance on that presented by the previous class. The hemispheres are large, and show an inclination to overlap the portions of the brain posterior to them. The cerebellum exhibits a regular advancement in development, coincident with that presented by the respective representatives of the class from Ophidia to Crocodilia, where avian peculiarities are anticipated.

As to the organs of special sense: In the serpents and a few lower lizards, eyelids are not present. When thus unprotected, the cornea is covered by a crystal-like scale which holds a thin layer of lachrymal fluid. Hearing is of varying delicacy. A

tympanic membrane, with its cavity and eustachian tube, is present in all the forms except the serpents and some footless lizards. The organs of smell are usually well developed, and in some aquatic forms the external nares are provided with valves. The sense of taste is often more or less defective, and its seat is probably not in the tongue alone, but also in special areas of the mucous membrane of the buccal cavity as well.

The jaws of all existing reptiles, excepting the turtles, are provided with small, sharp, often recurved, prehensile teeth, which never serve the office of mastication, but are used to grasp and retain the prey. Teeth may also be on the palatine and pterygoid bones. (The specialized maxillary teeth of the poisonous serpents will be mentioned in connection with that group.) Salivary glands are present in both serpents and lizards, and sub-lingual glands are characteristic of the turtles. The oesophagus is long, capable of great dilatation, and its walls are usually longitudinally folded, though in turtles they are provided with papillae; it leads into a stomach, transversely placed in Chelonia, though longitudinal in other forms. The intestine, in all save

the herbivorous turtles, is short and but little coiled, and ends in the cloaca, which opens externally by a round opening, or in serpents and lizards by a transverse slit.

Respiration is always performed by means of lungs, and these, except in the serpents and the apodal lizards, are of equal size and of the ordinary structure. Air enters through the slit-like glottis and reaches the lungs by passing down an elongated trachea and bronchial tubes. The ribs play a most important part in breathing; though the rigidity of the carapax and plastron of the turtles compels the members of this group to force the air into the lungs by swallowing it.

The organs of circulation are of particular interest, as they present the several stages of development from that of the batrachians to birds.

FIG. 206.—Heart of lizard from beneath; the aerated blood indicated by dots, the un-aerated by crosses; *a*, abdominal or descending aorta; *c*, carotid artery; *l*, left auricle; *L*, lungs; *pa*, pulmonary artery; *pv*, pulmonary vein; *r*, right auricle; *s*, subclavian artery; *t*, trachea; *v*, ventricle; *I*, *II*, *III*, *IV*, remnants of branchial arches.

The right auricle is the larger and receives the systemic, while the left receives the pulmonary veins. The ventricles are only partially separated from each other in the lower forms, and mix, to a greater or less extent, the venous with the arterial blood. Right and left aortic arches are present. The crocodiles, however, have the ventricles separated by a partition, and a structure resembling that of birds is obtained. The right aortic arch and carotids arise from the left ventricle, while from the right ventricle arise a left aortic arch and the pulmonary arteries.

The renal organs are in the hinder region of the trunk, and the turtles and lizards have the urinary bladder appended to the anterior wall of the cloaca, into which also open the genital ducts. The reproductive organs are more or less bird-like, the intromit-

tent organ of the male in the lower forms (Ophidia and Lacertilia) is paired. Though, as a rule, reptiles are oviparous, there are several forms which retain the eggs, until they are hatched, in an enlargement of the ovarian tube. These forms, of which many viperine snakes, as well as the horned toads and some of the apodal lizards, are illustrative, are said to be ovoviviparous.

As to the developmental history of this branch, that of the birds is foreshadowed. The egg is of considerable size, and often contains a supply of food for the growing embryo. By a folding together of the ventral walls of the body, the embryo, though at first lying prone upon the egg, is finally only connected with it by a small peduncle, the umbilicus, through which is drawn the nourishment of the food yolk.

The amnion is a thin membrane enclosing the embryo, which floats in liquid. The allantois is an organ of embryonic life, and performs the office of a respiratory sac. It is appended to the posterior portion of the alimentary tract, and is only met with in those animals which are unprovided with gills, and which do not, on leaving the egg, pass through metamorphoses. These two organs, the amnion and allantois, first appear in the reptiles.

Having now, in a cursory way, examined the general points of structure presented by the various members of the class, an inquiry into its relations can be profitably made; it is here that the real value of paleontology presents itself. By considering the fossil forms, the reptiles are seen to pass imperceptibly into the birds, and the birds are found to reach over, as it were, and greet the reptiles. The dinosaurs were reptiles having the pelvis, hind limbs, and feet strongly resembling those of the ostrich, and some of the bones of the body were supplied with air-cavities. Many were biped, the anterior limbs being extremely small. That they were provided with teeth does not argue their non-avian affinities, for the lower birds, like *Hesperornis*, were well supplied with these organs of prehension. The most remarkable avian peculiarities are presented by members of the highest order, Pterosauria. These flying reptiles had the bones of the fore limbs resembling, to no little extent, those of birds; the neck and head were long; the jaws were sometimes toothless, and encased in horn; the tail was short, and the shoulder-girdle, keeled sternum, and hollow bones carried the resemblance still further. As a result of these resemblances, together with those advanced by the anatomist and embryologist, the birds have been united with the reptiles into a single group, the Sauropsida, the propriety of which arrangement is daily more and more evident.

Although the snakes and a few lizards extend well up into the temperate regions, which is the true home of the turtles, by far the greater number are found in the torrid zone, from which the Crocodilia do not ordinarily wander. As reptiles are animals illy adapted for migration, they endure the cold of winter by passing into a torpid sleep—hibernation, and the enormous heat of the tropical sun by a somewhat similar summer sleep.

Reptiles first made their geological appearance during the carboniferous age, and abounded during the mesozoic, when they were rulers of the air, land, and sea. The classification now generally adopted divides the class Reptilia into eleven orders.

ORDER I. — OPHIDIA.

The characteristics which separate the ophidians or serpents from the other orders of the Reptiles may be briefly stated as follows: An elongated body, protected by scales, which cover, proportionally, much less of the integument than those of the higher reptiles, or those of the fishes, and are so attached as to allow considerable distention of the underlying skin. Limbs are rarely represented, and never except as a pair of posterior rudiments. The tongue, capable of protrusion, is of a dark red or blue-black color. A urinary bladder is not present. Though themselves small in diameter, the ophidians prey on animals of considerable size, and that these may be swallowed whole, the entire structure of the body is specially adapted. The bones of the skeleton, including those of the head, except those whose special function is to protect the brain, are not ankylosed as in most other animals, but connected by ligaments only, allowing the bones considerable individual movement; this specialization is characteristic. In general form the serpents may be regularly cylindrical, there being no external constrictions marking the divisions of the body, as head, trunk, and tail; or the several portions may be very distinctly shown. The head is, in the majority of common snakes, of a depressed, conical shape, though in some it is flat and triangular, or rounded and fusiform. The mouth is generally large and distensible; though in forms like *Typhlops*, it is small, and capable of only limited expansion. The body—or, more properly, the trunk—is ordinarily cylindrical, though many forms have the power of laterally expanding it so as to give them, when viewed from above, the appearance of more than actual size, this habit is possessed by many of the Proteroglyphs, forms like *Naja* having even the bones of the neck specialized to this end. Lateral compression and vertical expansion is characteristic of many innocuous forms, especially so of the tree-snakes. The tail of ophidians, that portion of the animal behind the vent, presents as much variation in general outline as any portion of the body. Though generally round and tapering, in *Silybura* it is short and truncate; in many underground snakes it is rounded, stout, and blunt, performing the office of a lever; and in the sea-snakes (Hydrophidæ) it is compressed and vertically expanded. It may be terminated by a small cap-like scale, as in many common forms, by a short spine, as in some of the Opoterodonta; by a long spine, as in *Acanthophis* and *Pityophis*; by a rattle, as in the Crotalidæ, or it may be simply fusiform and sealed.

In regard to the organs of special sense, the ophidians are somewhat defective. The sense of sight, from observations made by Dr. Yarrow, seems to be more or less imperfect, and though the eyes, being unprovided with lids, must be incessantly on the alert, they are by no means the chief organs for discovering the whereabouts of the prey, the senses of smell and touch here being of chief value. Younger snakes have the eyes proportionally larger. The sense of hearing is dull, so much so that "as deaf as an adder" has become proverbial. There are no external organs of hearing, and it is probable that reptiles feel the jar produced by an approaching animal rather than that they distinctly hear it. The sense of smell is more acute, and by it the animals find their food, as well as their mates; many are known to exude a most permeating odor. The nostrils are placed at the apex of the snout, and, in those forms which are aquatic, are provided with valves. The tongue is a tactile organ,

and, by a special opening between the plates of the front of the mouth, can be protruded while the jaws are closed; in the Hydrophidæ a special arrangement permits this without admitting the water. The sense of taste is probably wanting, as the reptile swallows its prey without mastication, though some forms crush it in the coils of the body. All ophidians are carnivorous.

The serpents are covered by an armature of scale-like folds of the skin, which are ordinarily imbricated, though in some forms they are merely juxtaposed. The armature of the lower surface of the body, in terrestrial forms, consists of a series of transversely elongated scales, known as abdominal scutes, and the head is in most cases protected by a regular arrangement of plates or shields. These shields, modified or otherwise, and their arrangement, are of great value in determining species, as they are very characteristic. The scales of the body are either smooth or provided with one or more longitudinal ridges, or carinae, and are arranged in longitudinal rows of equal number each side of the vertebral ridge, along which there is generally a more or less peculiar series, though in *Stenostoma* and *Herpetodryas* this row is absent, making an even number of rows. In some forms, like *Naja*, which distend their necks, the number of rows in that region is increased. The ventral scutes are

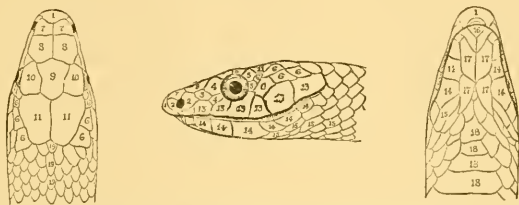


FIG. 267.—Upper, side, and lower views of head of snake, to show the plates covering it. 1, rostral; 2, nasal; 3, loreal; 4, preoculars or anteorbitals; 5, postoculars or postorbitals; 6, temporals; 7, internasals; 8, prefrontals; 9, frontal; 10, superciliary or supraocular; 11, parietals; 13, labials; 14, infralabials; 15, gular; 16, mentals; 17, sub-mentals; 18, ventrals; 19, dorsals.

ordinarily entire in outline, though in Dendrophidæ they have a pair of notches, and in Hydrophidæ they are replaced by scales of the ordinary kind. As each of these abdominal scutes is attached to a pair of ribs, their number corresponds with the number of vertebræ, and is hence of considerable diagnostic value. The scute immediately in front of the anus is often divided, as are those underlying the tail, the sub-caudals.

Of the plates of the head it may be said that, as they vary but little in different individuals of the same species, they are the most important factors in specific determination. They are named from the parts of the head which they protect. The frontal scute overlies the frontal bones, and is generally entire; posterior to it is the pair of parietals, while anterior are the prefrontals, or, as they are sometimes called, posterior nasals. Bordering on the parietals, frontal and prefrontals, and extending out over the eyes, are the supraorbitals or supraciliary plates, while posterior to the parietals are the generally scale-like occipitals. At the point of the snout is the rostral, and lying between it and the prefrontals are the internasals. The labials line the upper lip, and in the pythons are deeply pitted. The lower lip is similarly armed by the infralabials. In front, the rostral is opposed to the mental or chin plate. Around the eye are anteriorly the preorbitals, posteriorly the postorbitals, and, frequently, below the

infraorbitals; behind the postorbitals are the subdivided temporals. The nostril opens through a plate, the nasal, which may be and often is divided; between it and the preorbitals is the loreal, a shield quite characteristic of harmless snakes. Posterior to the mental, and lying between the infralabials, are the submentals and gulars.

Ordinarily the serpents have regular periods of sloughing the skin, which differ with different forms. Some little time before the change takes place, the waste skin so cleaves from the eyeballs as to render the serpent partially blind, making it unusually irritable. The skin then splits away from the margin of the mouth, and either by gliding through some narrow opening, or by passing through a ring of its own body, the serpent emerges, leaving its old coat turned inside out, but in perfect condition. If, as often happens in confinement, the animal has become ill, the sloughing is only partial, and, losing all appetite, it eventually dies.

As a rule, with the exception of a hiss produced by forcibly expelling the breath, the serpents are dumb; though Krefft maintains that some make a drumming noise, and the Indian *Ptyas mucosus* is said to give rise to a note like that of a tuning-fork. Garman has observed that some of the boas whine.

The progression of ophidians is reducible to three modes. The animal may glide, perhaps in a perfectly straight line, by use of its ventral scutes, each, on finding some resistance, forcibly pushing the animal forward. It may walk, by allowing each scute to act as a pair of feet, the lateral portions being alternately carried forward and pushed back; an undulatory movement like that of myriapods would result from this mode. The third manner is by pushing, as the underground snakes do almost exclusively. Ordinarily ophidians combine the three methods. The sea-snakes progress by an undulatory movement, and by the sculling action of the paddle-like tail. No serpent can move forward on a perfectly smooth surface.

It is impossible for any ophidian to jump, and it is with extreme difficulty that more than the anterior half of the body can be raised, unassisted, from the ground, though with some support, as the side of a box, the animal can stand almost vertically. In habits they are chiefly diurnal, though there are several tropical forms which hunt during the night. Most, if not all, have some period of the year during which they become inactive. In the torrid zone this may be called æstivation, while in the colder climates it is true hibernation, the animal being apparently in deep sleep; though if kept warm and constantly irritated it will pass the winter as it does the summer, and without any ill effects.

The coloration of ophidians is varied, and offers some of the most striking illustrations of adaptation and protective resemblance. Some of the rattle-snakes, which live in more wooded sections, are, on exposure on the hot neighboring plains, changed to a much lighter shade, and the members of all families have the general coloration harmonizing well with their surroundings. The tree-snakes are always of colors resembling either the leaves or twigs among which they live. The common grass-snake, *Cyclophis vernalis*, offers an excellent illustration of adaptive color. In the tropics many perfectly harmless forms have adopted the coloring of the most venomous, while the *Tropidonotus macrophthalmus* offers perhaps the most wonderful illustration of protective resemblance known to the order. This innocent animal has not only the general form, habits, and markings of the deadly cobra, but even that animal's distensible neck and elongated ribs,—a perfect counterfeit.

Whether snakes swallow their young has been much discussed. The case stands

thus: Many people maintain they have seen the animals pass into the mother's mouth in time of danger; some fishes, *Arii*, are known to protect their young by retaining them in the mouth; a male amphibian, *Rhinoderma darwini*, carries the eggs in a laryngeal pouch until they are well developed; young serpents could live for some time shut up in the mouth, gullet, or even stomach of their parents; the belief is an old one and well established. On the other hand, no naturalist of good standing has ever been able to observe the young serpents thus seek safety; and of the serpents found in the gullet of dissected snakes, all have been of a different species, or immature individuals of the same species as their devourers, and were undoubtedly taken as food.

The skeleton of ophidians is chiefly axial, there never being any pectoral girdle, and only rarely (in Ophiderodonta and a few families of Colubriformia, as the Tortricidæ, Pythonidæ, and Boidæ) a pelvic girdle with rudimentary limbs. When the hind limbs are present, they appear, externally, as two short claws or processes each side of the anus, and are probably used as clasping organs. The two rami of the lower jaw are not united in front by a bony symphysis, but by an elastic ligament, giving them considerable lateral expansion with the ordinary vertical movement. The bones of the upper jaw are also so connected with the other bones of the face as to allow more or less individual movement. The teeth are never permanent, but are capable of being renewed, like those of fishes, as soon as the old ones are worthless. They all point backward, and those of the palatine and pterygoid bones resemble the armature of the jaws.

The vertebrae are concave in front and convex behind, and connected by free ball and socket joints, twisting being prevented by horizontal articular surfaces; those of the body seldom exceed three hundred in number. The ribs are the chief organs of locomotion, being attached at their free ends not to a sternum but to the ventral scutes.

The alimentary system is elongate and adapted to the general form of the body. In the distensible mouth the food is subjected to the treatment of saliva, which, in its ordinary form or as poison, is given off in considerable quantities, and materially aids in the process of digestion. The stomach is a simple enlargement at the end of the œsophagus, provided with longitudinal folds, and in turn leads into a relatively short intestine. The liver is asymmetrical, and passes from the anteriorly placed heart to the pylorus; its reservoir, the gall bladder, is somewhat removed, and is placed, with the pancreas and spleen, in a fold of the duodenum. Though serpents drink a great deal of water, and will perish if it is not given them, they have been kept for months without nourishment of any kind whatever.

The respiratory system is peculiarly specialized. The lungs are paired only in the boas, some Proteroglyphs, and the Crotalidae, in other forms only one is developed, which may be specialized into an air-sac posteriorly, its fellow appearing only as a rudiment. The trachea is long and may be provided with air-cells, and the larynx can be projected

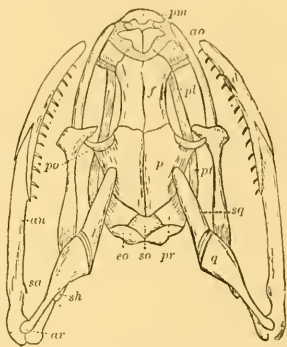


FIG. 208.—Skull of snake (*Tropidonotus*); *an*, angular; *ao*, antorbital; *ar*, articular; *d*, dentary; *eo*, exoccipital; *f*, frontal; *p*, parietal; *pl*, palatine; *pm*, premaxillary; *pr*, prootic; *pt*, pterygoid; *q*, quadrate; *sq*, surangular; *sh*, stylolhyoid; *so*, supraoccipital; *sq*, squamosal.

during the tedious process of swallowing, when, too, the tracheal air sacs and the posterior reservoir come into play.

The ovaries and testes are paired; the right, however, is often the larger and placed in advance of the left. The male has a pair of intromittent organs, which are grooved, and, when in use, are everted, like the finger of a glove. Some species have these organs armed with sharp spines or hooks, anticipating the special development of some of the rodents. No urinary bladder is found in Ophidia.

The eggs of serpents are oblong in form and covered by a leathery envelope, for the rupture of which the embryos are provided with an egg-tooth, a special development like that of the chick. The eggs, whose embryos are well advanced before deposition, are ordinarily left to care for themselves, though the pythons continue to protect them, winding their body around, and, with their feeble heat, incubating them. In some forms, especially the members of the Solenoglypha and some of the Proteroglyphs, the eggs hatch in the oviduct, an occurrence which may happen in snakes ordinarily oviparous, and the young are thus *born*. The classification herein adopted arranges all the members of the order Ophidia in four sub-orders: Opoterodonta, with non-distensible mouth, facial bones immovably connected, teeth only in one of the jaws, and the posterior limbs as rudiments; Colubriformia, having teeth in both jaws, no fangs, and including all the more common harmless snakes; Proteroglypha, poisonous snakes, with large, permanently erect, grooved fangs, which are placed anteriorly in the upper jaw, and are usually immediately followed by ordinary teeth; Solenoglypha, with the perforated fangs unaccompanied with ordinary teeth and capable of being depressed.

SUB-ORDER I.—OPOTERODONTA.

The first sub-order includes those forms which, because of their imperfect eyesight (rendered so by the odd arrangement of the lateral cervical plates, which so cover the eye as to render vision extremely indistinct), are popularly known as ‘blind-worms.’ They are provided with a narrow, non-distensible mouth, and the bones of the head are more firmly united together than those of other ophidians. The solid, hooked teeth are only in one jaw (upper or lower) and the body is terminated by a short tail. Posterior limbs are sometimes present as rudiments. The larger number of species belong to the genus *Typhlops*.

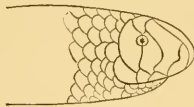


FIG. 209.—Head of *Typhlops*.

The TYPHLOPIDE are very generally distributed over the warmer portions of the globe, four species being found in our country north of Panama. To the naturalist they are most interesting forms and are eagerly sought after. They are the lowest as well as the smallest ophidians,—an ordinary earth-worm is gigantic when compared with some. Their short muscular body, designed for underground tunnelling, rudimentary eyes, and peculiar dentition, are special points of interest. The genus *Typhlops* has the body covered with small imbricate scales; the tongue forked; a pair of scarcely discernible eyes; and the lungs unequal in size. The head may be obtuse, depressed, or in some species drawn out into a horny tip; the tail may also be ensheathed in horn, as is the case with *Typhlops philippinus*. The upper jaw is toothed. Many species of this genus inhabit British India, where, after showers, they come above ground and are very active.

Of the four American species, *T. longissimus* is a doubtful form, which has not been met with since the time of its description by Dumeril and Bibron. *T. perditus* and *T. busimaculatus* are Mexican forms in which the eyes are invisible. The general color of the latter is yellow, but the more dorsal scales are minutely spotted at their bases, while the head and tail are immaculate. *T. cinctus* is very long and slender, though the tail is not longer than the diameter of the body. The color is silvery brown, the snout and lips light yellow. It is found from Panama northward.

Australia has nearly a dozen species of this genus, most of which have been named after men who have distinguished themselves as herpetologists. They are all underground forms, chiefly feeding on ants and their eggs. In burrowing they are greatly facilitated by the general form of their body, which is of a larger diameter posteriorly and is terminated by a short acuminate tail.

A second genus, *Anomalopis*, characterized by having the crown shields regularly arranged, is found in Mexico. *A. mexicanus* is long and slender, with tail like *Typhlops*, and eyes visible through the semi-transparent ocular shield. The labials are only two in number, though the previous genus is provided with four. The color is reddish-brown, of a lighter shade below; the yellowish-white border of the individual scales gives the animal the appearance of being reticulated. The genus *Stenostomus* is provided with teeth in the lower jaw, and the shields of the crown are reduced to scales. The ocular is large and transparent, displaying the eye beneath. Members of this genus are quite abundant in Mexico, a form having the scales arranged in fourteen longitudinal rows, the two labials separated by the ocular, and the infra-labials four, inhabits Texas, and is known as *S. dulce*. Allied to this is *S. rubellum*, which has five infralabials and reaches a length of eight inches.

SUB-ORDER II. — COLUBRIFORMIA.

This group embraces all the harmless ophidians except the forms already treated under the head of *Opoterodonta*. As a general rule these serpents have the maxillary and mandibular, as well as the palatine and pterygoid bones, well provided with small recurved teeth, and in some forms those of the mandible, posteriorly, may become fang-like and conduct poison from a venom gland. Such forms are, however, rare, and, though evidently poisonous, are not regarded as being dangerous. The several members present a great variety of form, and can more easily be distinguished from other sub-orders than they can be comprehensively defined as members of a single group circumscribed by distinctive characters. The colubriform snakes are found in the temperate regions, usually as terrestrial forms, while in the tropics they are not only found on the ground, but many are arboreal. Aquatic forms are abundant in some localities. Not only are colubriform snakes beneficial in destroying vermin, such as mice and rats in the southern states, and the troublesome pouched-gophers, *Geomys bursarius*, in the West, but some of these innocuous forms do not hesitate to battle with the most poisonous *Solenoglyphs*, which they often defeat.

As before said, though the majority of colubriform snakes are harmless, and are only too glad to retreat from the sight of a human being, a few are aggressive. Some of the tree-snakes, *Dendrophidae*, do not hesitate to spitefully attack travelers as they pass unsuspectingly through the jungles, and often—as they choose the eye as the point of attack—inflit dangerous wounds. The pythons have been known to attack

and kill full-grown men by their powerful coils, though those reptiles are ordinarily of a most timid nature, retreating on the least disturbance. The variations in form presented by the sub-order have their extremes in the short thick body of the Tortricidae, or the bluntly terminated body of *Silybura*, and the slender elongated form presented by many of the Dendrophidæ. A few, such as the pythons and boas, and some of the Erycidae, as well as the Tortricidae, have the pelvic limbs represented by a pair of anal claws.

The first to be treated, and, consequently, the lowest family of colubriform snakes, includes a number of Asiatic underground forms, having many characters in common with the Typhlopidae, united under the name UROPELTIDÆ, or shield-tails. The members of this family have the cylindrical body passing without any visible constriction into the short pointed head. The tail is abbreviated and often terminates abruptly in a naked disc, or, in the genus *Silybura*, covered with keeled scales. The eyes are very small, and the cleft of the mouth of inconsiderable width, and not distensible; the jaws are armed with but a small number of teeth. The shield-tails, it will thus be seen, are adapted for an underground life, where they find larvæ, worms, and ants' eggs, of which latter they are very fond. Though seldom met with, they are very abundant in numbers, and chiefly inhabit the island of Ceylon, though some forms are found on the neighboring mainland. The genus *Rhinophis* includes several Cinghalese species, characterized by having the nasal plates separated by the rostral; and the tail, which is shorter in the female, covered by smooth scales, and terminated by a rough shield. *R. oxyrhynchus* reaches a length of fifteen inches, and is found in the loam at a depth of two or three feet, as well as in ant-hills. *R. punctatus*, which attains the length of nineteen inches, is the largest species.

Of the genus *Uropeltis*, only a single species, *U. grandis*, the largest of the family, is known. It inhabits the mountains of Ceylon and is extremely rare. The genus *Silybura* includes a number of species which have the scales of the abrupt tail strongly keeled, and the supra-orbital and postocular shields confluent. *S. macrolepis* is represented by a single Indian specimen measuring ten inches in length. *Plecturus* has only two uninteresting forms. The final genus of the Uropeltidae contains but a single species, *Melanophidium wynaadense*, which has the termination of the tail armed with a rough horny point. The genus and species have been described from a specimen captured at Wynaad at an elevation of 3,500 feet.

The second family, TORTRICIDÆ, or short-tails, have the short, blunt head depressed, and not distinctly marked off from the body, which is protected by evenly laid, smooth plates, those of the ventral side exceeding the others but little in size. The eyes are small; the labials but six in number; and the teeth are few but stout. The most noteworthy feature, however, is the rudimentary pelvis, which bears a pair of small limbs which make their appearance each side of the base of the tail as small claws. Members of this family are found in both hemispheres, where they prefer the dry and sandy districts, burrowing near the surface for subterranean worms and insects. *Tortrix scytale* is beautifully banded with black, and does not exceed two feet in length. Its habitat is the valley of the Amazon, the natives often wearing it as an animated neck-ornament. *T. cryx* inhabits southern Europe and Egypt. The genus *Cylindrophis* is characterized by the absence of intermaxillary teeth. But three species are known, two of which inhabit British India, where, being, like the other members of the family, sub-terrestrial, they are seldom found.

To the family Tortricidae may be appended the genus *Xenopeltis*, to which some

naturalists give a family value. *Xenopeltis* has eight labial plates, and the ventral scales well developed; it is represented by a single species, *X. unicolor*, which inhabits Borneo, Sumatra, Java, the Celebes, and other neighboring islands, as well as a portion of British India. In its habits it is nocturnal, and obtains its prey of small mammals by entering their burrows. Being a large and stout animal, sometimes reaching the length of four feet, it has little difficulty in overpowering its victims.

The third family embraces the ERYCINÆ, or sand-snakes. Members of this group have a small conical prominence on each side of the vent, somewhat resembling the anal spurs of the Boidæ; the tail, however, is much shortened, and, instead of being

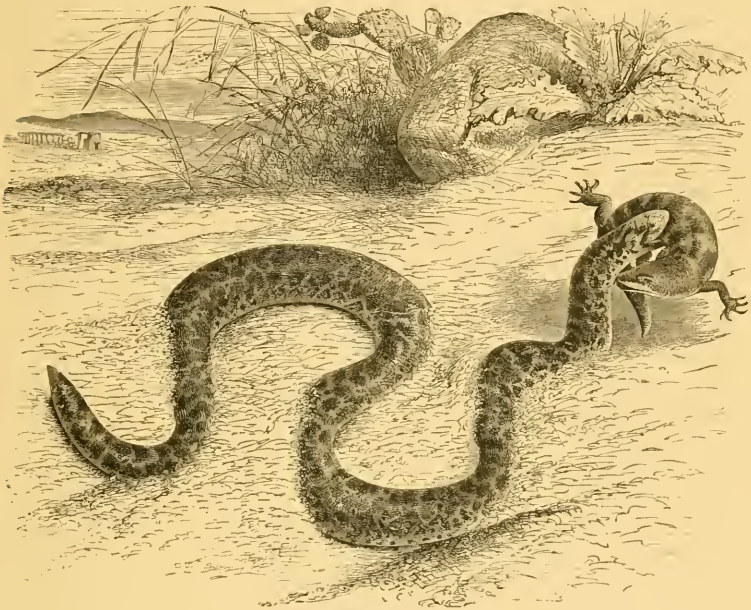


FIG. 210. — *Eryx jaculus*, sand-snake.

used as a prehensile organ, is so developed as to act as a lever, assisting the animal in working its way into the coarse gravel of the barren plains which it inhabits. Nearly every desert has its representatives of these most interesting reptiles: America has *Charina plumbea*. *Eryx jaculus* is restricted to southern Europe and Persia, while in India is found the harmless *Eryx johnii*, which the serpent-charmers so mutilate about the short, rounded tail, as to give the animal the appearance of having a posterior head, — a monster regarded with the utmost horror by the ignorant natives. In confinement this Indian form constantly remains hid in the gravel of its cage, from which it cannot be induced to appear, except by offering it the most tempting morsels. In its native haunts, the treeless deserts, the animal is probably crepuscular, as its food — mice

and small reptiles—is much more abundant at evening, or during the early morning, than under the enormous heat of a nearly vertical sun.

We now come to those ophidians, *Pythonidae*, which, because of their great size, have been known from the time of the earliest writers. Though of dimensions large enough to satisfy the cravings of the ordinary searcher after the marvellous, they have nevertheless been the subject for most exaggerated stories, and it is extremely difficult to find data which have not been more or less subject to the influence of imagination. The ancient writers were especially fond of magnifying the powers of these serpents. Valerius Maximus writes: "And since we are on the subject of uncommon phenomena, we may here mention the serpent so eloquently and accurately recorded by Livy; who says, that near the river Bagrada, in Africa, a snake was seen of so enormous a magnitude as to prevent the army of Attilius Regulus from the use of the river; and after snatching up several soldiers with its enormous mouth, and devouring them, and killing several more by striking and squeezing them with the spires of its tail, was at length destroyed by assailing it with all the force of military engines and showers of stones, after it had withstood the attack of their spears and darts: that it was regarded by the whole army as a more formidable enemy than even Carthage itself; and that the whole adjacent region being tainted with the pestilential effluvia proceeding from its remains, and the waters with its blood, the Roman army was obliged to remove its station: he also adds, that the skin of the monster, measuring 120 feet in length, was sent to Rome as a trophy." Kreffit, alluding to this piece of remarkable history, says; "Snakes 10 to 14 feet long are considered very large now-a-days, and in former ages may have kept armies at bay, but our better acquaintance with their habits enables us to treat them with the contempt they deserve."

Not only has the size of these animals been exaggerated, but their swallowing powers have, in some works, appeared as almost unlimited. The animals on which the pythons ordinarily feed are seldom larger than a small dog, and though they may seize and overpower animals as large as a goat, to swallow them "horns and all" is absolutely impossible.

The *Pythonidae*, in general structure as well as in their habits, resemble the *Boeidae*, though they are all Old World forms, and have some of the labials deeply pitted, a characteristic which at once determines them. There are skeletal characters also which can be made use of in identification. In the boas the frontal bones are broader than long, while the opposite holds for the pythons. The rock-snakes, or *Pythonidae*, inhabit tropical Asia, Africa, and Australia, and though accounts are not rare of their attaining the fabulous length of forty feet, specimens by actual measurement very rarely reach one half that length. The body is rounded; tail prehensile; head depressed and rounded in front; eyes of moderate size, the elliptical pupil having its longer diameter vertical; scales smooth, subcaudals in two rows; some of the labials are pitted; teeth on the intermaxillary, maxillary, palatine, pterygoid and mandibular bones and none grooved; and the adults are provided with rudimentary hind limbs, placed each side of the vent, and called 'spurs.' These organs are supposed by the natives to be used in fighting, though they probably have sexual functions, or may be of use in grasping the limbs of trees as the animal swings over the surface of the water. Pythons generally prefer those localities which border on some quiet pool, where they lie in wait, either suspended from an overhanging limb, or hid in the luxuriant vegetation of the ground, or possibly partly submerged in the water, waiting the arrival of some small animal, which, as it is about to drink, the reptile seizes by the snout,



Eunectes murinus, anaconda.

and, after wrapping several coils of its body about it, strangles. Finally, having crushed the larger bones, the process of deglutition is begun, which may last for several hours; the head invariably being the first to pass into the gullet, the body following. As the teeth all point inwards, and the jaws are successively and alternately pushed forward and drawn back, the prey, if not too large, is thus of necessity drawn into the mouth. The reptile may, however, find that its food is not suitable, or it may need to take breath, and though the prey has passed some way down the œsophagus, it is not unfrequently disgorged, making its appearance as a most frightfully contorted mass, covered with mucus from the alimentary tract; its slimy appearance having undoubtedly given rise to the false notion that the animal covers its prey, previous to deglutition, with saliva. For some time after the reptile has taken a large meal, it is, either from fatigue or from the effects of so loading its stomach, extremely lazy and inactive, being not infrequently quite indifferent to what may be going on about it. The inactivity of menagerie specimens, however, is due rather to the enfeebling effect of a cold climate, rather than torpor resulting from overfeeding, or gentleness from kind treatment. It is in their native forests that these forms must be studied to be admired. Not only are the caged animals inactive, but the purple bloom, so characteristic of the healthy animal, is invariably defective or lost; the rough treatment to which they are subjected, as well as a disease of the jaw, — caries, — rendering them indifferent and unhealthy.

It is not an unusual occurrence for the female python, which exceeds the male in size, to deposit her eggs while in confinement and watch over them with the most zealous care. Observations have been made which prove that the eggs are actually incubated. The mother, after arranging them in a convenient pile, coils her body, the temperature of which is considerably above the normal, around and over them, remaining in this position until the eggs, at the end of about three months, are hatched. We have here among the reptiles an undoubted instance of maternal solicitude.

Python reticulatus has the following characteristic marking. The underlying color is light yellowish-brown or olive, and the head and neck is ornamented by a dark brown line passing from the tip of the snout backwards, on each side of which are two bands passing from the eyes to the angles of the mouth. Along the back a series of black rings bordered with white, spotted scales gives the animal a netted appearance, from which it has received its specific name, *reticulatus*. The netted python is found quite abundantly in nearly all the islands of the Malay Archipelago, as well as in Burmah and Siam, where it is called Ular Sawad.

Mr. Wallace, in his description of these islands, gives an account of a python which illustrates the bold and independent yet helpless nature of this, or a closely allied, mammoth serpent. It seems that during the evening, while the naturalist was interesting himself with his books and insects, a python took up its abode in the thatched roof directly over the bed, not making its presence known, however, until the following afternoon, when it was finally disposed of by a native well accustomed to its habits, though it evinced all the indignation of a regular tenant.

Python molurus, the adjiger of the Hindus, inhabits the peninsula of India as far north as the Himalahs and also possibly the Malay peninsula and Java. Like other members of the family, it prefers the low moist lands in the neighborhood of water, where it captures birds and small quadrupeds, such as fawns and rodents. It differs from the previous species in several particulars. *P. molurus* has the two anterior upper labials, and four of the lower labials, deeply dented with pits, while *P. reticu-*

latus has four upper and several lower labials similarly developed. *P. molurus* has its light, greyish-brown body ornamented with a dorsal row of large square spots, below which are two lateral rows. The top of the head is ornamented with a lance-shaped blotch, along each side of which lie a pair of dark brown lines, which pass from the nostrils, through the eye, to the sides of the head, where each meets a similar streak from the lower jaw.

Python regia, the royal rock-snake, having the four anterior upper labials pitted,



FIG. 211. — *Python sebae*, fetich-snake.

and the lower labials broad and four in number, inhabits western Africa. It is of a dark brown color, almost black, and has a series of light spots along the middle of the back, and two more along the sides, beneath the lips and chin are white. This python is quite often seen in menageries and traveling shows. *P. natalensis*, the Natal rock-snake, is regarded with respect by the natives, believing that it has some mystic influence over their destinies. It lives on small quadrupeds, remaining quite torpid for some time after its meal. At this time it is quite easily disposed of. *P. sebae* is a

form often met with in zoological gardens, where it is known as the fetich-snake. Its home is in the warmer parts of Africa.

In Australia there are at least six species of Pythonidae and more genera than of any other innocuous family. The representatives are the largest ophidian inhabitants, some reaching the length of ten feet. They are nocturnal and move during the day only when compelled to. The genus *Morrelia* has the rostral plate, as well as the anterior three labials and the posterior infralabials, provided with deep pits. *M. spilotes* is of a glossy black color, with a bright yellow spot on every scale; the abdominal scutes are yellow, with shades of black. This animal may be distinguished, as can the other Australian rock-snakes, from the numerous poisonous forms inhabiting the same country, by the large number of scale rows, there being from forty to fifty in the pythons, while the largest number known among the poisonous snakes is twenty-six. It is a strange coincidence that while the so-called 'diamond snake' of Australia, the form now under consideration, is harmless, the *Hoplocephalus superbus*, inhabiting the neighboring island of Tasmania, and bearing the same vernacular name, is highly venomous. *M. spilotes* has a very limited distribution in southeastern Australia, being only found from the coast to the Blue Mountains, but is represented further west by the following species. The individuals of this species inhabit nearly every region that offers shelter, though stony ridges supplied with trees and well watered seem to be their favorite localities. It is in such places that they can find young water-rats, (*Hydromys*) ducks, and possibly the straying chickens of a neighboring farmer. Though naturally unobtrusive, when irritated they bite severely. The eggs of either this or the following species have been found. They were neatly piled up in a nest of dry grass, which was concealed in a hollow log. *M. variegata*, or the carpet-snake, closely resembles the diamond in its habits and structure, though its habitat is defined and separate. It is found in every other part of the continent except southern Victoria, the region of the diamond snake. In coloring it is of a uniform greenish brown with irregular markings; different specimens show a great variation due to age and locality. In their movements and general habits the carpet and diamond snakes are similar, though the former may be somewhat the larger.

The genus *Aspidiotes* has the scales in fifty-two rows and reaches a length of eight feet, and may possibly grow larger, even exceeding the *Mordias* in size. The species are not well known, and only a few specimens have been captured. *A. melanocephalus* is at once recognized by its jet-black head and neck, its small scales, narrow abdominal plates, and the absence of pits in the labials. The general color is light brown, with darker rings above, and yellowish white below. Allied to this genus is *Liastis*, the representatives of which have some of the upper and lower labials pitted. The few species are found in the islands of the Arafura sea. *Nardoa* has only the posterior infralabial pitted. *N. gilbertii* has a length of from three to six feet. Of its habits little is known.

Of the family of boas, the BOMAE, it may be said that its members are distinctively New World, resembling the pythons in their habits, and in being of enormous size, but differing from them in several structural particulars. The boas have the body long and fusiform; the head distinct and flattened; the snout prominent; the tail generally prehensile; the nasal plates may be entire or divided; the nostrils lateral. The labials are generally without the pits so characteristic of the Old World forms, many of the cephalic shields are divided, and the sub-caudals are entire.

Boa imperator, or the emperor, is found in Central America and Mexico, and may

possibly be regarded as a northern variety of the more tropical *Boa constrictor*, though the scales of the head are rather large. The general color is brownish, with a dorsal series of quadrangular brown spots, which is separated from the smaller spots of the flanks by a pair of light lateral lines. *B. constrictor*, though properly an inhabitant of Brazil, is represented in Central America by a variety, *isthmica*. Along the back is a series of transverse brown bands, each connected with the marks of the flanks by a latero-posterior isthmus, and along each side of the belly is a series of more



FIG. 212. — *Boa constrictor*.

or less broken, irregular spots of a black color. *B. mexicana* is allied to *B. imperator*. *B. constrictor*, proper, inhabits the more tropical portions of South America, though travelers from all parts of the world have almost invariably described large serpents which have come under their notice as 'Boa-constrictors,' rendering it extremely difficult to determine accurately what species they are describing, and bringing the name to so general a use that it has almost lost the primary significance given it by its original propounder, Linné.

Eunectes murinus, the anaconda, is also a native of tropical America, and is represented in the engraving as in its native haunt, the low land by some pool or sluggish stream, about to seize a 'boat-bill.' The anaconda is one of the largest representatives of the family, and is beautifully ornamented over a groundwork of rich brown, by a double series of blotches along the back, and with irregular annular spots along the sides.



FIG. 213. — *Xiphosoma caninum*, dog-headed boa.

Xiphosoma caninum, or the dog-headed boa, inhabits Brazil, and is of a green color with light dorsal bands. The labial plates resemble those of the pythons in being deeply pitted.

Epicrates cenchria, the ringed boa or aboma, was at one time worshipped as a god by the ancient Mexicans, who often offered to it human sacrifices. In its habits it is a true member of the family, strangling its prey by winding around it fold on fold of its ponderous body. Its general color is of a dark yellowish gray, ornamented with a dorsal row of large brown rings, and along the sides by variable blotches of a dark color, having in their centre a lighter crescentic ornament.

A large number of the smaller serpents are united under the name CALAMARIDÆ, or dwarf-snakes. The members of this group are found in nearly every country of the globe, living beneath stones and prostrate logs. Their diminutive size and nondistensible neck compels them to restrict their diet to such small grubs and worms as they can easily master and swallow; while they are thus employing themselves they not infrequently become the prey of some larger foraging reptile. The genus *Calamaria* which is only found in the East Indies, has the labial plates reduced to four or five. Though there are several species, they resemble each other so closely that they can be classified only after considerable trouble. The *Elapes* are their particular enemies. The genus *Geophis* is represented in America by four species, all of which inhabit Mexico, where are also found the genera *Ficimia*, *Cheilorhina*, *Stenorhina* and *Tantilla*. *Virginia striatula* is a little snake found in the south, from Virginia to Texas.

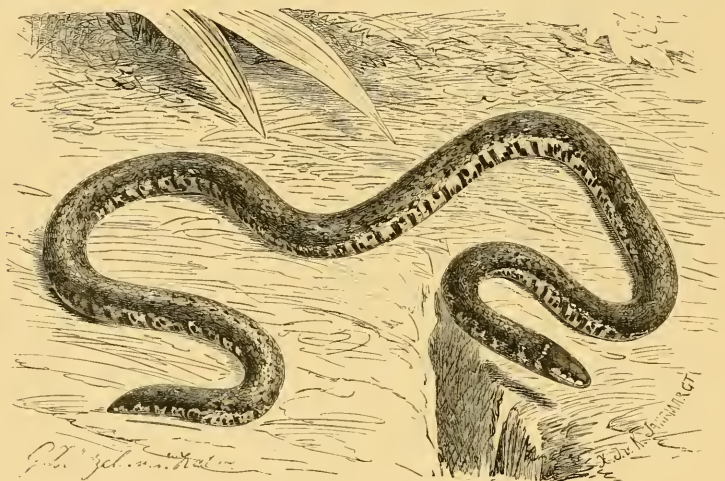


FIG. 214. — *Calamaria albiventer*.

It is a modest and most inoffensive reptile; its reddish-brown back and salmon-colored inferior surface form a combination far too pleasing to be hid away, as it too often is, beneath the bark of some old dead tree or log.

The genus *Carpophis* is very generally distributed; in the United States, the species *amœna*, inhabiting the more eastern and northern portions, as the thunder, ground, or worm-snake, is most familiar. In its habits it is nocturnal and sub-terrestrial, being much more often turned up by the plough, or brought to light by the hoe, than seen naturally on the surface. It, moreover, always seeks escape by burrowing, rather than by flight; indeed, the animal's motions, when out of its element, are most awkward. In general coloration it resembles the previous species. The East Indian *Oligodorus* belong to this family, and are characterized by the absence of palatine teeth, and by their peculiar physiognomy, the head being short and blunt. Closely resembling the *Oligodorus*, externally, are the members of the genus *Simotes*, which,

however, have an armature of palatine teeth, and reach a considerable size. They are known in southern Asia, as well as on the neighboring islands, from their fierce habits.

We now come to a large family of cosmopolitan ophidians, the CORONELLIDÆ, found in nearly every country, though rare in Australia. They have the body tapering towards each end; the head, which is separated from the body by a distinctly constricted neck, depressed, short, and often obtuse; the scales of the body are usually smooth, and arranged in from thirteen to twenty-three rows, and in size the magnitude of many members of the genus *Coluber* is not reached. Though generally inactive, on being attacked they defend themselves with considerable energy. In coloration, being mostly terrestrial forms, they are generally dull, though some which

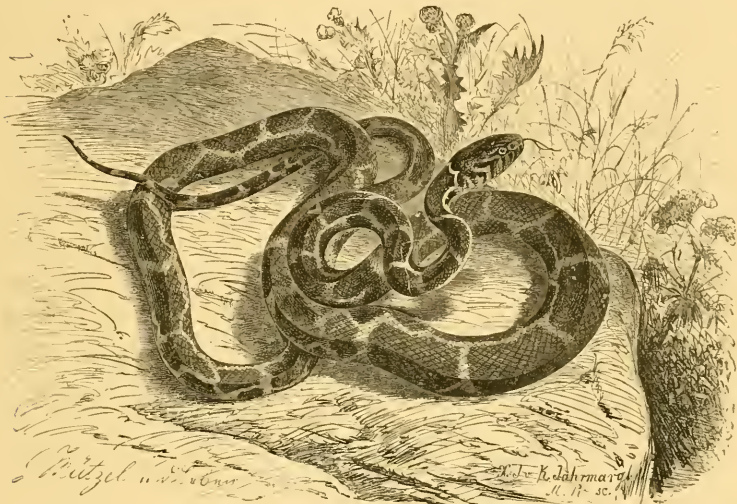


FIG. 215. — *Ophibolus getulus*, chain-snake,

inhabit grass land, are bright-colored, and are among the most graceful, as well as most beautiful, of ophidians.

The genus *Coronella* includes a number of purely terrestrial forms, inhabiting nearly every temperate and tropical country. *Coronella austriaca* is very generally distributed throughout Europe, where it is often mistaken for the viper. It has, on rare occasions, been found in England. *C. cana* inhabits south Africa. *C. orientalis* is described as the only representative of the genus in India, and the *C. australis*, or the Australian ground-snake, has been described from a single specimen in the British Museum. As considerable work has been done on the Australian snakes by native naturalists, and as no second specimen has been discovered, the form must be extremely rare. It not only represents the genus, but the family, in the insular continent.

In North America, the family under consideration is represented by several

common serpents belonging to the genera *Ophibolus*, *Diadophis* and *Heterodon*. *Ophibolus triangulus*, the milk-snake, is found from Canada to Virginia, and has received, from its habit of frequenting old cellars and out-houses, while in search of mice and small vermin, snakes and lizards, the name of house-snake; its confidence has been taken advantage of, however, and it has, of late, become quite uncommon. It is a most beautiful, graceful, and active animal, and the slender body sometimes reaches a length of four feet. The chain-snake, *Ophibolus getulus*, is a more southern animal. In the south it is one of the most beautiful, as it is one of the most common, snakes. Its body is of an intense black, ornamented by a series of narrow, white rings, from the arrangement of which the animal has received its common name. The negroes hold this serpent in the highest respect, and even give to it the name of 'king.' They maintain that it exercises dominion over the other reptiles, and can meet and overcome the deadly rattler. The diet of the chain-snake is ordinarily made up of lizards, salamanders, small birds, and mice, as well as weaker members of its own species.

Diadophis punctatus, or, as it is more popularly called, the ring or collared-snake, is one of the most beautiful reptiles of our continent, over which it is very generally distributed, east of the great plains. In its choice of raiment *Diadophis* has shown most excellent taste, and, at the same time, good judgment. Above, a dark sage-green, given the appearance of Highland plaid by the regularly arranged scales, harmonizes with the shades of vegetation in which the little fellow searches for his luncheon of bright-colored beetles and grasshoppers. He seems to know that below he can wear a little bright color, which, being hid from above, will not attract the attention of his enemies; so he has decked himself in an orange waistcoat, sometimes ornamented with a double row of black buttons, and finally finished his dandy costume by putting on a white collar and black cravat. From its gandy attire the ring-snake is often selected as a pet, and soon becomes accustomed to its new surroundings.

Having a distribution very nearly coincident with *Diadophis punctatus*, though a much less interesting animal in appearance, is the puffing-adder, hog-nosed snake, or sand-viper, *Heterodon platyrhinos*. This serpent is large and unsightly. The rostral plate is so formed as to resemble the up-turned snout of the hog, and when surprised, if retreat is impossible, it flattens itself out, appearing to be twice its ordinary size. It delights in dry, sandy districts, where it sometimes remains perfectly motionless, basking in the sun for hours at a time; or it may partly bury itself in the loose sand, using its peculiar snout as a spade. From its uncount appearance this reptile is generally considered to be extremely poisonous. It is strange that such a character should be given to a form which is perfectly harmless, and can be induced to *feign* the aggressive only after protracted ill-treatment. I have repeatedly placed my finger in the mouth of one that seemed to be of the most ferocious disposition, but no attempt was made to bite. Of a half dozen North American *Heterodons*, the one under consideration, which inhabits the United States, east of the Mississippi, is most familiar, though it is in part replaced, in the south, by a black variety. The females are very prolific, as many as one hundred and eleven being born of a specimen in the National Museum. *Heterodon* is also found in Madagascar, and in Chili, both being beautiful examples of the genus. Allied is *Psammodromus rhombatus*, which is abundant in South Africa, where it is known as the schaap-sticker. It is a very graceful and active animal, about two feet in length, and feeds on small lizards and insects. Considerable variety of coloring is shown by specimens of unlike ages and from different localities.

In the family COLUBRIDÆ have been placed the greater number of non-venomous ophidians which do not present any striking characters either as to their habits or structure; a description must therefore be general. Body of moderate length and breadth; head well-proportioned and separated from the body by a more or less constricted neck; eyes and mouth of moderate size; teeth covering both jaws and palate, and never presenting any special development; the plates of the head are evenly arranged, and those of the body never present any outline or structure deviating greatly from the normal. So few prominent structural variations are presented by the several forms, that grouping from this standpoint is difficult and, at best, unsatisfactory. Some naturalists have endeavored to base an arrangement on habits. Yet, as many forms are intermediate, and others unite the habits of evidently widely separated groups, this plan is even more unsatisfactory than the first. The family is cosmopolitan, its members being found in nearly every country under the tropical and temperate sun. Australia and some of the Pacific islands, however, are not represented. North America has a large number of forms, included in several genera, the distinctive features of which are chiefly based on the arrangement of the cervical plates.

The introductory genus is *Cyclophis*, which is represented by one of the most beautiful, as it is one of the most familiar, reptiles, the green-snake, *Cyclophis vernalis*. This is a most gentle and harmless ophidian, allowing itself to be handled in the roughest way, and seldom offering the least opposition. Specimens are often captured and made pets of, living in confinement for considerable periods of time. In nature they are found in moist meadow-lands, where they are concealed by their protective color, and where they find an abundance of insect life well suited for their food. The green-snake is not only found on the ground, however, but is an active climber, and may not infrequently be seen entwined among the branches of bushes or of low trees. The genus is represented in India by a much larger form, *C. major*, which sometimes exceeds three feet in length.

Closely related to *Cyclophis* is the genus *Herpetodryas*, representatives of which are found in both hemispheres. They are elongated forms, adapted to an arboreal life, their colors, shades of green and brown, being well adapted to conceal them. *H. carinatus* is found in Brazil and Surinam, and is peculiar in that it has no vertebral row of scales, the several series of the body always being in an even number.

The genus *Coluber* has many interesting forms, native as well as exotic. The Alleghanian variety of *C. obsoletus*, the mountain black-snake, has received considerable attention, from its distribution. It was first detected in New England, along the Connecticut valley, where it attracted attention as a black-snake having the scales keeled, the ordinary *Bascanium constrictor* having the scales smooth, and though since found in other eastern localities, its proper home is among the mountains of the Appalachian range, where it sometimes reaches a length of seven feet. In confinement its temperament is quite different from that of its smooth-scaled cousin, being mild and gentle. *C. guttatus*, the corn-snake, inhabits the southeastern part of the United States, and was first described, in 1743, by Catesby, as follows: "It is all over beautifully marked with red and white, which seems to have given it the name of corn-snake, there being some maize or Indian corn much resembling this in color; they are robbers of hen-roosts, otherwise they are harmless." In its habits the present form differs from the majority of our common snakes in being crepuscular, spending the day hid away in some crevice. In length the corn-snake sometimes reaches five feet. This form has been a great stumbling block to herpetologists, having been described under a dozen different

names. *C. vulpinus*, the fox-snake, has been captured in Massachusetts, though its home is further west. *C. quadrivittatus*, or chicken-snake, as it has been called by the negroes, frequently enters the southern cabins for rats and young fowl. The body is of a dark olive color, ornamented with four longitudinal brown bands. Of exotic *Colubers*, *C. coreas*, of Surinam, is the largest, and *C. quater-radiatus*, the largest of Europe. The *Æsculapian*-snake, *C. æsculapii*, is the most common European type. Often they are seen in museums and menageries, where they become very tame. This form was introduced into the mythology of the ancients, who twined it around the staff of *Æsculapius* and the caduceus of Mercury, which, when thus equipped, were supposed to be possessed of the most wonderful virtues.

The genus *Bascanium* is represented in North America by five species, and twice as many varieties. The most characteristic, as well as the most familiar form, and the common black-snake, *B. constrictor*, inhabiting the United States east of the Rocky Mountains, and its variety, *vetustum*, west to the Pacific, while *mentovarius* extends further south, through Mexico to Tehuantepec. The common black-snake is most often found in the neighborhood of water, and is particularly partial to thickets of alders, where it can hunt for toads, mice, and birds, and, being an excellent climber, it is often seen among the branches of small trees and bushes, hunting for young birds in the nest. While on these plundering expeditions the reptile is often followed by a troop of small birds in the greatest flutter of excitement. The black-snake does not always remain in unfrequented localities, however, but is often surprised in old fields, by the roadside, and will even enter barns and seize chickens. At these times, the rapidity with which it retreats, on being surprised, has given the animal, in some localities, the name of 'racer.' As long as retreat is offered there is no resistance, though if cornered, or during the breeding season, the usual mild temper gives place to a most irascible disposition; this is very characteristic of the animal when in confinement, as it is always quarrelling and biting its fellow-prisoners, as often as the opportunity presents itself. The racer has been known to follow people, though this is more generally from a spirit of investigation, rather than from any design on the part of the animal to attack the object of its pursuit. Dr. Yarrow, however, knows of an instance in which a female, with its young, on being surprised by a small girl, entwined itself around the child's neck, biting her, meanwhile, in the face, and would probably have strangled her, were it not for the timely arrival of assistance.

The young of this species are peculiar; instead of being black, as is the parent, they are of an olivaceous color, ornamented with a dorsal series of dark-edged brown spots, with lateral rows of spots of still darker color. The head is a dark chestnut shade, mottled with brown.

Pennant's early description of this form illustrates the tendency to exaggerate, evinced by many old writers; an inclination, by the way, which has not entirely passed by. He says: "Many ridiculous frights have happened from this innocent reptile. As everyone in America is full of the dread of the rattle-snake, they are apt to fly at the sight of any of the serpent kind. This pursues, soon overtakes, and, twisting round the legs of the fugitive, soon brings him to the ground; but he happily receives no hurt but what may result from the fright; all the mischief this species does is to the housewives, for it will skim their milk pans of the cream, and rob their hen-roosts of all the eggs."

Closely related to the black-snake is the coach-whip snake, *B. flagelliformis*, which inhabits the south, as far west as the Mississippi, where its variety, *testaceum*, extends

to the Pacific. The general form is greatly elongated, resembling in this respect some of the Dendrophidie, as specimens are sometimes six feet in length. They are most beautiful animals, and so fleet in their movement as to almost fly over the ground. Though ordinarily inoffensive, on being attacked they defend themselves with vigor. Batram, in his "Travels in Carolina," speaks of once finding a hawk so wound up by one of these serpents as to be rendered almost helpless. The name 'coach-whip' is not given because of the elongated body, but from the arrangement of the juxtaposed caudal scales, which resemble a braided raw-hide whip. Catesby mentions a peculiar belief, among the Indians, that the snake will, by a jerk of its tail, separate a man in two parts; and the negroes of the south, to-day believe that it can flagellate a man to death. *B. tentatum* is found from the plains to the Pacific. While *B. constrictor* has the scales of the back in seventeen rows, *B. tentatum* has them in fifteen, and is, moreover, ornamented with a brown dorsal band and with lateral lines of orange, red, or yellow. The inferior surface is anteriorly spotted with brown.

The genus *Spilotes* is represented in North America by two species which differ from the members of the previous genus in having the teeth equal and smooth—the 'black-snakes' have them larger posteriorly. *S. couperi* inhabiting the Gulf states and Georgia, from its enormous size, is the most interesting form. In coloring it is of a deep black, shading into yellow on the throat. It is known by the negroes as the indigo or gopher-snake, and, though sometimes reaching the enormous length of ten feet, it is never molested by them, as they suppose it to be, like the king-snake (*Ophiobolus getulus*), a mortal enemy to the rattler.

Pityophis has the scales keeled, the nasal plate divided, and the last abdominal plate entire. *P. melanoleucus*, the pine or bull-snake, is found east of the Mississippi and south of the Ohio rivers, and it is particularly fond of the pine forests. Though one of the largest North American serpents, it is extremely active, disappearing almost instantly on being surprised, though this may be due to the fact that it not unfrequently has underground holes into which it retreats, and from the immediate vicinity of which it seldom journeys. To obtain its prey it chooses a likely locality, and waits in patience for some unsuspecting rabbit or squirrel to pass by. *P. bellona* inhabits the west, feeding, as do many of the genus, on mice, gophers, and other small vermin, and doing, in this way, immense benefit to the agricultural interests, as the gophers, as well as other small rodents, are perfect pests of the western farmer. The western bull-snake not unfrequently exceeds the length of six feet, but it is of a peaceful disposition. Captured individuals of this species have been known, even when concealed, to attract others. It is not an unusual occurrence for the mate of a serpent which has been killed to search for, find the body, even when it has been dragged for some distance, and remain by it apparently with a feeling of sorrow if not of revenge.

The Indian rat-snake, *Ptyas mucosus*, is very abundant in southern India and Ceylon, where it often enters human dwellings while in pursuit of rats or chickens. It is always ready, on the slightest irritation, to bite, and, as it grows to a considerable size, often reaching seven feet in length, it gives considerable annoyance to the natives. When angry, the rat-snake is said to produce a peculiar musical note not unlike that of a tuning-fork. In general structure it resembles our common black-snakes.

The genus *Dromiscus* is common in the West Indies, South America, and Mexico. A single species, *D. flavilatus*, has been found in the southeastern United States, there being in the National Museum a single specimen from Florida, and a second from North Carolina. *D. ater* is the 'gray-snake' of Jamaica, and is often seen about

old ruins, lurking in some cranny for the approach of an unlucky lizard. If irritated, it will dart at its adversary with all the savage vehemence of the most venomous moccasin, and, as it strikes for the eyes, its attacks not unfrequently prove dangerous.

Zamenis includes those Old World snakes, found about the Mediterranean and in India, which generally have the last maxillary tooth enlarged and separated from its fellows by a short interspace. Of the genus *Xenelaphis* but a single species has been described; a few specimens, some measuring six feet in length, have been captured in the East Indies. *Philodryas viridissimus*, a most beautiful example of the Colubridæ, and connecting them with the Dendrophidæ, inhabits Brazil, where, because of its slender body and beautiful green color, it has received the name of emerald whip-snake. It lives on young birds, and on such small prey as it may capture while meandering among the branches of the tropical forests.

The members of the family DENDROPHIDÆ, or tree-snakes, are found sporting amid the luxuriant foliage of tropical America, Asia, and to a less extent, Africa and Australia. To adapt them for an arboreal life, the body and tail is greatly elongated, and each ventral scute is usually provided with a pair of keels by which the animal can the more firmly grasp the smooth branches. The genus *Dendrophis* includes a large number of species, which are frequently adorned with the brightest colors, of which green is often the prevailing tint. The head, which is distinct from the neck, is narrow, long, and depressed, the snout being very prominent. Two species, representing two genera, are natives of Mexico, *Leptophis mexicanus*, and *Oxybelis aeneus*, which latter species, though of small diameter, reaches a length of four feet. The Boom-Slange, *Bucephalus capensis*, of South Africa, presents so much variation in its marking that several species have been described by those unprovided with a sufficient number of specimens. Though the inhabitants of South Africa consider this form to be poisonous, on dissection no venom glands have been found, though the teeth are covered with a slimy secretion, which may be possessed of irritating qualities. Allied to *Bucephalus* is *Ahatullaliocercus*, one of the most beautiful of tree-snakes, inhabiting Borneo, where the native children are said to often make a pet of it, the harmless reptile coiling around their arms and bodies without their evincing the slightest alarm and naught but pleasure. In its native haunts the animal is most active, leaping from branch to branch of the highest trees, and directing its lithe form with lightning celerity towards any unfortunate lizard or beetle which it may chance to espy. Living also in Borneo, as well as on neighboring islands, is the larger *Goniosoma oxycephalum*, which reaches a length of eighty-two inches. It is said to be a most active and ferocious animal, defending itself, when attacked, with great energy.

The tree-snakes proper are included in the genus *Dendrophis*, and are characterized by having an obtuse snout, equal teeth, and smooth vertebral scales. *Dendrophis picta* is the most common East Indian form, and, like *Bucephalus*, it is liable to great variation in color. *D. punctulata* is a beautiful animal inhabiting Australia, and growing to a length of five or six feet. It is of an olive-green color above, and pale yellow below; the shades of color, however, appear to depend on surroundings, as specimens in captivity are never so brilliant as those seen gliding along the grass-land, or swinging from branch to branch of the lofty trees. The nearness to the time of exuviation has also considerable to do with the coloring; specimens just after the old epidermis is shed being very brilliant. The eye of this form is large; the teeth small and of uniform size, and the dorsal row of scales considerably exceeds in size those of the scales of the body. A loreal, a scale generally characteristic of this as

well as of other innocuous ophidians, is present, and the assumed shape of the body when the animal is angry is compressed, instead of depressed like that of venomous forms, of which the laterally extended neck of the *Naja* presents the best type. It seldom attempts to bite, and can be ordinarily handled without showing any resistance. The food consists of batrachians, saurians, young birds, and possibly insects. It is probably oviparous, and is found in all but the southern portion of the Australian continent. *D. calligaster* is a more northern form. It is small, not reaching a length of three feet, has no loreal shield, and below is purplish-yellow.

Chrysopelea orna, because of the innumerable varieties of marking which it presents, almost defies specific description. It is considered by Günther to be the most beautiful of all snakes. In its habits it is arboreal, being able to even pass down a smooth and vertical tree-trunk. It is a widely-distributed form, inhabiting southern Asia and the East Indian archipelago. Its food consists of geckoes and other small saurians.

The family DRYOPHIDÆ includes some of the most interesting forms of the serpent tribe. In the genus *Dryophis*, not only is the body so slender and elongated as to reach a length of nearly five feet, with a diameter of less than an inch, but the head is also slender, with the muzzle projecting for some little distance as a pointed proboscis. Representatives of this group are found in Asia and America, though the most interesting form inhabits Madagascar. The Old World species have the maxillary teeth grooved, while the American forms have them less specialized. The prevalent color is green, with two longitudinal white stripes along the lower side. The longer diameter of the pupil is horizontal, a position which possibly points to the nocturnal habits of the animal.

The most remarkable representative of the family is the langaha, *Dryophis langaha* of Madagascar, which, though its body is less than three feet long, has a scaly proboscis, often flattened into a leaf-like organ, half an inch in length. The general color of the animal is a deep brown. *Tragops prasinus*, or as it is sometimes called, *Dryophis nasutus*, is a beautiful grass-green animal, living in the jungles of India, and often reaching the length of seven feet. To it has been attributed the habit of darting at the eyes of passers-by, an action which has made it particularly disliked by the natives. The snout is greatly prolonged, and provided with a movable fleshy tip.

Passerita has the snout much produced, as in langaha. That this development is used merely as a tactile organ, such as are the tentacles of *Herpeton*, is questionable. While *Herpeton* is semi-aquatic, and would find tentacles, which would do away with the necessity of it protruding its tongue, a most useful acquisition, *Passerita* is an ordinary tree-snake in its habits, so that its tongue can, unhindered, perform its ordinary functions. The rostral prolongation is moreover covered with rough scales, and can only be imperfectly sensitive. It seems that the true office of this development is to increase the size of the opening of the mouth, as do the marginal bristles of the mouth of some birds — for example, the night-hawks (Caprimulgidæ).

The NATICIDÆ, which includes many of our most common snakes, unites forms so diverse that clear definition is almost impossible. It includes serpents which may be small or large, slender or stout; the eyes are of medium size; the teeth variable; and the scales either keeled or smooth. The several genera are well circumscribed, though the family is difficult to define. They prefer the neighborhood of water, in which, if the case demands it, they are expert swimmers. They differ from many other Colubriform snakes in their habit of beginning the process of deglutition as soon as their prey is

seized, without first waiting for it to die. This habit has often resulted in considerable interest to those unfamiliar with it. Not infrequently the snake can be induced, on irritation, to disgorge a well-seasoned meal, which often appears as a lively frog, that hops away with all the experience, if without the understanding, of Jonah. The habit may also explain the almost universal belief, of which more has been said in the introduction, that certain snakes swallow their young in time of danger. Since a serpent, that had been made a meal of would live for some little time after being swallowed, and if, in the meantime, the feasting snake were killed, the imprisoned animal would, if liberated, crawl away with all the experience of the frog.

We will first treat one of the largest genera, and the one that is the most typical of the family; its members are recognized by their keeled scales, regular arrangement of the cervical plates, and by the numerous teeth of the jaws and palate, of which the



FIG. 216. — *Tropidonotus natrix*, 'common snake' of Europe.

anterior are shortest. The *Tropidonoti* are found in the neighborhood of water, as a general rule, and, though not aquatic, are excellent swimmers, and, on being surprised, will often choose this means of escape. Members of the genus are abundant in North America, Europe, Asia, and a portion of Australia, as well as some of the islands of the Eastern Archipelago, though rare in Africa and South America.

The illustration which has been selected to represent this large genus is that of *Tropidonotus natrix*, a form which is abundant throughout Europe, being particularly fond of the neighborhood of ponds and streams, into which it often voluntarily plunges, sometimes coiling itself up and remaining at the bottom for hours at a time. With the common people it is known as the ringed or grass-snake, and is often tamed, soon learning to distinguish its friends. In confinement it will eat beetles, grasshoppers, frogs, and even bread and milk. Of the dozen or more American representatives of this genus, *Tropidonotus sipedon* is, perhaps, the most familiar. This snake is found in

the vicinity of nearly every slow-running stream, brook, or pond, where they often startle the angler, either by their exertions to escape in the rushes or semi-aquatic bushes, or by boldly plunging into the water, in which they also often capture their food, which consists of frogs, toads, or fish, and, being excellent swimmers, they are not infrequently seen in the middle of ponds, and are especially abundant about lily-pads. They are said to frequently take the hook, when it is baited with a worm or small minnow, but when captured will fight like a tiger. In many portions of the south this snake is called the water-moccasin, and is considered very poisonous. While dying, the lower side of the body often takes on an iridescent character, the rapid changes of the prismatic colors being particularly beautiful. Specimens over three feet in length are rare. The Australian fresh-water-snake, *T. picturatus*, varies much in color, being either gray or deep brown, with a salmon-colored abdomen, and spotted along the sides with a double series of red dots. It resembles, in general marking, the *Tropidechis*, a venomous form; the two can easily be distinguished, however, as *T. picturatus* has fifteen dorsal and lateral rows of scales, while *Tropidechis* has more than twenty. The species under consideration has been observed to congregate in great numbers, during the early evening, around lagoons and water-holes, though during the day few or none are to be seen. Of the score or more of Indian *Tropidonoti*, *T. macrophthalmus* is the most interesting form, for, though it is a perfectly harmless animal, it superficially resembles the cobra so exactly as to often deceive those well acquainted with both animals. The resemblance is further carried out in that the neck is capable of expanding horizontally, and is provided with a larger number of scales than is the rest of the body. This animal, inhabiting the Himmaleh mountains, offers one of the most interesting instances of protective resemblance in the animal kingdom.

Also abounding in species, of which, in North America alone, there are about a score, is the genus *Eutania*, to which our most familiar serpents belong. *E. saurita* and *E. sirtalis*, are seen by the dozens, during a country walk, of a bright summer's day, anywhere in the more eastern portions of the United States. In general marking the two so nearly resemble each other that they are ordinarily considered to be similar, being popularly called striped or garter-snakes. *T. saurita*, however, is longer and much more slender than *T. sirtalis*, and is found in more moist localities. The collector will capture many more of these forms than of any other, except, possibly, the green-snake. The eggs of *Tropidonotus* are sometimes found about out-buildings, and in hatching give birth to little fellows having enormous eyes and a spotted body, the longitudinal bands of the adults only being gained after several sloughings of the skin. These cast-off skins are very abundantly found among piles of rubbish, or under the loose bark of decaying trees. They are eagerly sought after by the great crested fly-catcher, *Myiarchus cristatus*, who uses them to line her nest. Though perfectly harmless, the garter-snakes are most offensive to handle. They exude a most fetid odor, which so possesses the power of penetration and adhesion as to render it quite impossible to rid one's self of it.

The genus *Storeria* is represented in the eastern United States by two species, both of small size, though interesting and graceful in their habits and motions. *Storeria occipitomaculata* is found throughout the Mississippi valley, and eastward, and is often captured in New England, where it has been called the spotted-necked-snake, on account of the three large, white, irregular blotches just back of the occipital plates. *S. dekayi* is equally abundant, and was first described, as was the previous species, from Massachusetts specimens. It frequents meadows and grass-ground, where it

feeds on insects, such as grasshoppers and crickets. *Helicops*, though a tropical genus, is represented in Florida by Allen's *Helicops*, a form which, because of the peculiar structure of the tail, stands well up, and perhaps should lead the genus. *Abastor erythrogrammus*, the so-called hoop-snake, though it possesses none of the remarkable qualities attributed to this monster of tradition, is an abundant species in the south. Though preferring damp and marshy ground, it never voluntarily takes to the water. *Farancia abacura*, inhabiting the south from the Carolinas to Texas, is a closely related form, though it is more shy and, consequently, apparently less abundant. It lacks the longitudinal dorsal ornamentation, and below is of a deep red color. It is called horn-snake by the negroes.

The family of desert-snakes, PSAMMOPHIDÆ, are chiefly inhabitants of tropical Africa, and are not very well known. In some points of structure they resemble the Dryophidæ, though members of this latter family can always be distinguished by their green coloration, and by their horizontally placed pupil: the desert-snakes are, moreover, provided with a pair of long maxillary teeth. *Psammophis elegans* is long and slender, though the other members of the family are stout, and adapted for a terrestrial life. *P. puberulentus* is a most repulsive reptile; its undefined ornamentation, swollen lips, and large, hidden fangs, give to it, on examination, a most venomous aspect. It is a small species, inhabiting southern Asia, and the neighboring islands. *Colepeltis lacertina* inhabits Egypt.

The HOMALOPSIDÆ includes fresh-water snakes, which sometimes swim down the rivers to the sea, and in general structure resemble the truly marine snakes, Hydrophidæ, with which they have sometimes been classified. They have the nostrils so placed upon the tip of the snout as to enable them to breathe without protruding but a small portion of the head from the water. They prey on fish and crustaceans, often lying in wait, their prehensile tails being entwined around some submerged branch; in captivity, however, they generally refuse all nourishment and soon die, otherwise they would make extremely interesting pets, being gentle and harmless. It is stated that the act of parturition is performed in the water, the known species being viviparous. The most interesting form is *Herpeton tentaculatum*, a species which, though often figured, is extremely rare, a single specimen having been unique for more than half a century, and now the species is only rarely seen in herpetological collections. It inhabits the southeastern portion of Asia, where it is occasionally found in muddy water, its tentacles serving as organs of touch. These rostral appendages are as long as the snout, and are covered with scales similar to those of the loreal region.

Hypsirhina is characterized by its smooth scales and united frontal plates. The species, about six in number, are restricted in their distribution to the East Indies. Cantor gives an interesting description of a specimen of *H. enhybris*, which he succeeded in keeping for a considerable time in captivity. "Members of this species may be seen in rivers as well as in irrigated fields and estuaries, preying upon fishes, which, however, it refuses in a state of captivity. It is of timid and peaceful habits. A large female, after having been confined upwards of six months in a glass vessel filled with water, brought forth eleven young ones. Shortly after the parturition she expired, under a few spasmodic movements; and also two of the young ones died in the course of about two hours, after having, like the rest, shed the integuments. In length they varied from six inches to six and two eighths. The living nine presented a most singular appearance; they remained a little way below the surface of the water, coiling themselves round the body of an adult male which was also kept in the vessel,

occasionally lifting their heads above the surface to breathe, at the same time resisting the efforts of the senior to free himself. Fishes and aquatic insects were refused, in consequence of which the young ones expired from inanition in the course of two months."

The family RACHIODONTIDÆ is represented in Africa and possibly in Asia. *Dasy-peltis inornatus* is frequently found under the bark of trees in the southeastern portions of Africa and presents one of the most interesting examples of adaptation for a special end. The Rachiodon has a general structure which enables it to lead an arboreal life, searching among the branches of the tropical trees for birds' eggs, and that the contents of the egg may not be prematurely freed while it is yet in the mouth, teeth are absent except in the angle of the jaws where they cannot reach the shell. When the egg reaches the esophagus it comes in contact with a row of "vertebral teeth," formed by the specialized inferior spinous processes of the first seven or eight cervical vertebrae, which are elongated and covered with enamel; by contraction of the muscles of the throat, these saw through the egg, the contents passing on to the stomach, while the limey shell is quickly ejected. *Elachistodon westermanni* is the Indian form. Though provided with the same peculiar vertebral teeth it is probably a member of another family.

The DIPSIDÆ, or night tree-snakes, includes a large number of serpents inhabiting the tropical regions generally, having an elongated compressed body, broad and triangular head, and with the posterior maxillary teeth grooved. In the New World a single species passes north of Mexico into Arizona and Texas, though other representatives are quite abundant further south, the genus *Leptognathus* reaching the Argentine Republic. *Dipsas* is found in Mexico and Brazil, as well as in India, Africa, and Australia. It is from a most strange and ancient belief that the genus has been thus named. *Dipsas*, which is derived from a Greek word meaning thirst, was given to this harmless reptile from the belief that the animal was possessed of a most insatiable thirst, to alleviate which it would often coil itself in the valuable springs of the deserts, polluting their water and imparting to their victim, should they sting the unfortunate traveler, an eternal thirst which could only be quenched by death.

Dipsas dendrophila is of large size, sometimes measuring seven feet in length. It is of a deep black color with numerous yellow cross-bars, which in some specimens are reduced to lateral spots. The lower portions are usually yellow, marbled with black. The species properly belongs to the East Indian archipelago, though it is occasionally found on the mainland about the Malay peninsula. Of the Indian *Dipsa*les proper it is worthy of note that they capture only warm-blooded animals, some being exclusively bird and others mammalian feeders. A single species, *D. fuscus*, inhabits Australia, and a closely related form is found on the island of New Guinea. Though the posterior maxillary tooth is long and grooved, the bite is not the least dangerous. Being nocturnal in their habits, they are not so abundant in collections as are their diurnal cousins the Dendrophidæ, though specimens have been taken all along the eastern coast, where, coiled up in the branches of some tree, they await the approach of night, when they sally forth to search for birds' eggs, insects, frogs, and the smaller Mammalia. In captivity they are said to be gentle, allowing themselves to be freely handled without evincing the slightest inclination to resist.

The blunt-head or *Amblycephalus boa* of Java, Borneo, and the neighboring islands, though classified among the Dipsadidæ, is an aberrant form; the head has

been compared with that of a dog, which animal it further resembles in its habit of snapping at whatever disturbs it. It often secretes itself in the thatched roofs of huts, where it finds a large assemblage of insects. The genus *Pareas* includes a few species inhabiting Java, and neighboring islands, which have the palatine and mandibular teeth gradually increasing in length from behind forwards.

The members of the family SCYTALIDÆ are closely related with those of Dipsadidæ. But three genera are known. *Oxyrhopus* *celia* and *doliatus* are found in Mexico, *Hologerrhum* inhabits the Philippines, and *Scytale* South America.

The family of LYCODONTIDÆ embraces a number of snakes of moderate length, with small eyes and generally vertical pupil. The shields of the head present nothing extraordinary; the dentition alone being prominently characteristic. The maxillary armament has anteriorly a pair of elongated teeth.



FIG. 217. — *Scytale coronata*.

From the peculiar shape of the pupil of this family it would seem that the members are nocturnal, yet this is not the case with most, as they feed almost exclusively on skinks, which can only be captured during the day. Some African Lycodonts are, however, nocturnal, feeding on mice.

The genus *Lycodon* includes some of the most common snakes of India, *L. audicus* being perhaps the most abundant. The fangs in the front of the jaws admirably adapt this animal for seizing and retaining the small hard-skinned saurians which form almost its only food. It is a small animal of only about two feet in length.

The highest family of colubrifform ophidians is made up of the wart-snakes, ACROCHORDIDÆ, which are disposed in three genera. *Acrochordus javanicus* has the body covered with small, wart-like, tubercular or spiny scales, no shields on the head, and no specialized ventral scutes; the tail is short and prehensile; the nostrils close together and at the tip of the snout. It is viviparous, as are the other members of the family,

as many as twenty-seven young being born at a time. Very few of these animals have ever been taken, though they are occasionally seen on the island of Java at Penang or Singapore. The savage appearance presented by its sullen eyes, swollen jaws, and short, thick body, is not such as would court a more intimate acquaintance. Allied to the preceding and also inhabiting the East Indies is *Chersydrus granulatus*, which has the hinder part of the body and tail slightly compressed, and its lateral surface increased by an inferior fold of skin along the abdomen and tail. The scales are



FIG. 218. — *Acrochordus javanicus*, wart-snake.

unprovided with the tubercles and spines of the previous genera, though both forms are alike in having no ventral scutes. This, as might be inferred from its structure, is a purely aquatic reptile, resembling in its habits the Hydrophidae, though it lacks the prolonged processes of the caudal vertebrae, and its bite is perfectly harmless. *C. granulatus* is found along the shores of the Eastern archipelago, New Guinea, and the Philippines, as well as on the east coast of the Indies, sometimes being found several

miles from land. *Xenodermus* differs from the other, the two already mentioned Arerchordidae in having well-developed ventral shields, and sub-caudal scales. It inhabits Java.

SUB-ORDER III.—PROTEROGLYPHA.

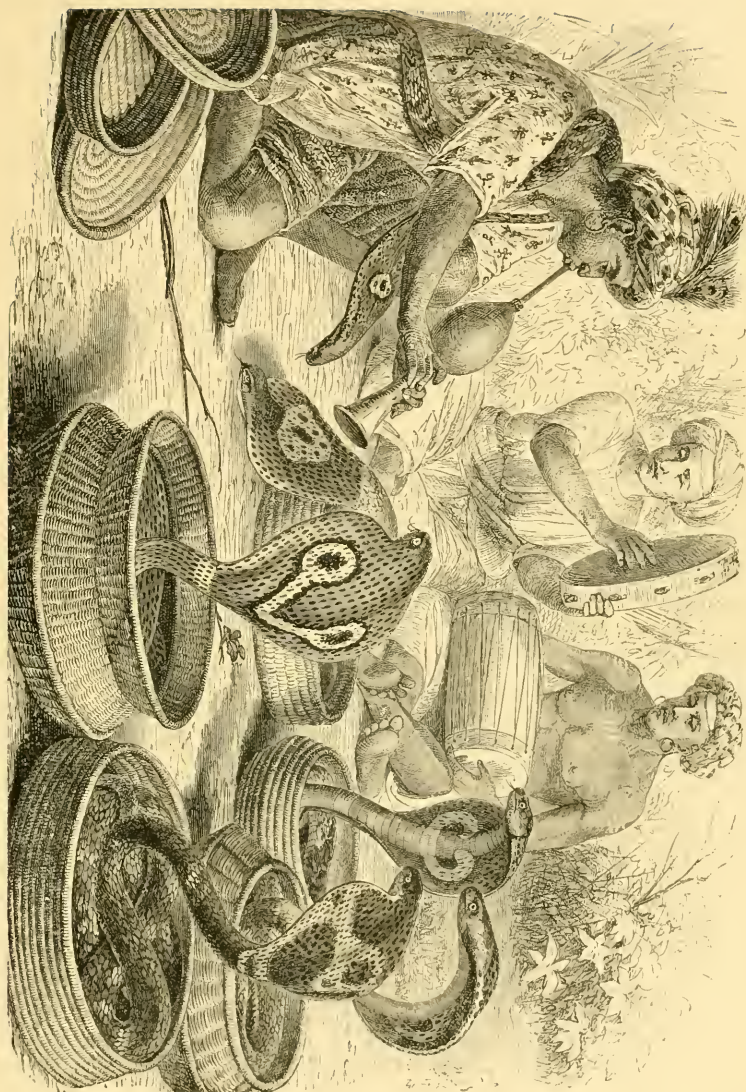
We now come to the snakes provided with poison-fangs; they have been divided into two groups, viz., those with permanently erect fangs, Proteroglypha, and those having fangs which can be erected or depressed at will, Solenoglypha.

In the first group, behind the erect grooved fangs is the usual armament of maxillary, palatine, pterygoid, and mandibular teeth, and the general form and external armature of the body generally resembles that of the Colubriformia. There are two families, the distinction being based on the general shape and structure of the tail.

The family ELAPIDÆ has the body cylindrical; the tail fusiform; the head with the usual armament of shields, though the loreal, with the exception of a single species, is always absent. The eye is small and has a round pupil, and the nostrils are placed laterally, while in the succeeding family they are, except in *Platurus*, placed dorsally on the tip of the snout. The fang is not only perforated by an internal canal which conducts the venom from the specialized salivary gland to the slit-like opening in the distal extremity, but along the front is a permanent groove. Members of the family inhabit all the tropical countries as well as, and especially, Australia, and are generally regarded with considerable fear by the natives.

The introductory species is the cobra of India, or, as it is known to science, the *Naja tripudians*, and is the most familiar, as it is the most dreaded, of the serpent tribe. Though *Ophiophagus*, of the same country, is the most venomous of ophidians, the naja is more abundant, and, being extremely poisonous—it being estimated that the annual mortality in the Indian peninsula, from its bite, is over 5000—is more feared than any other reptile. Though several varieties of this dangerous animal exist, there is in India but a single species, which is also found throughout the islands of the Malay archipelago. While hunting for its food, of small reptiles, frogs, and fishes, it may climb to the roofs of huts, among the limbs of trees, or even enter the water, where it is an expert swimmer, being sometimes found at a considerable distance from land. It is often nocturnal in its habits, and is ovoviviparous. Its natural enemies are jungle-fowl, which devour the young, and the ichneumonous *Herpestes*, which will overpower the largest adults.

The cobra-da-capello, being the most common venomous reptile of India, an object of curiosity to the Europeans, the sole source of subsistence of innumerable vagrant snake-charmers, and an object of intense interest to naturalists, has probably received more attention than any other ophidian, not excepting the rattle-snake. Those bitten by the animal seldom escape death, and, of the few that do, many are subject to periodic returns of the most excruciating pain. Ordinarily, on being attacked, if no antidote is administered, the poison almost instantaneously affects the whole system. The reptiles seem to be well aware of the fatal power possessed by themselves as well as by their fellows, for while, in confinement, they will attack and kill any snake of a different kind that may be presented, for their own species they evince the greatest respect, though, when several are closely confined in the same apartment, trouble may occur. They soon become accustomed to menagerie life, and often live to an old age. When thus confined, the animal, during the day, is lazy and inactive, seldom stirring



Snake charming, colour-plate.

except when irritated, or to occasionally drink ; at night it is active and restless. The front of the glass cage containing these animals at the Zoological Gardens in London has to be painted, that the serpents may not kill themselves by striking against the otherwise invisible obstacle when irritated by visitors.

In its general form the *Naja* differs from other snakes, excepting the related *Ophiophagus*, the superficially similar *Tropidonotus macrothalmus*, and a few Australian forms, in possessing a dilatable neck, the ribs of which are greatly elongated and flattened. The reptile, when excited, is capable of expanding the neck to a width several times exceeding that of the head, the cervical scales being much more numerous across the back of the thus formed 'hood,' as the expanded portion is called, than they are further down the body. The hood, in the ordinary form, is ornamented with a pair of dark spots on its upper side, which, being connected by a cross-bar, bear a strong resemblance to a pair of spectacles, from which fact the animal is not infrequently known as the spectacle-snake. The explanation of the origin of this ornament as given by the superstitious Buddhists, who always treat the reptile with the greatest reverence and behold its maltreatment with horror, is that Buddha, weary with his labors, was lying asleep in the direct rays of the sun, when, seeing which, a cobra so elevated himself and expanded his hood as to shield the deity. On waking up, Buddha was so pleased with the act that he promised to repay the considerate reptile, which promise, however, he soon forgot. It seems that at this time a kite preyed on the cobras, and to such an extent that a total extinction of the race seemed inevitable ; in despair, and as a last resort, the cobra ventured to remind the god of his promise, and begged protection from the enemy of his race. Buddha then placed the black marks on his hood, which so surprised and frightened the kites as to render the cobras forever free from their attacks. This attributed act of protection has so influenced the ignorant natives that they do not dare protect themselves from an animal which is yearly killing off thousands of their race.

The fangs of the *Naja* are long and grooved, having the foramen at their extremity so situated that the slightest scratch will prove inoculative. Behind the fangs are a few ordinary teeth. In coloring the reptile varies greatly ; it may be of a uniform brownish-olive above, with white, black-edged 'spectacles,' uniform dark brown with black spectacles ; blackish-brown with a pair of white spots in place of the spectacles, or it may even have no marking on the neck whatever ; or a uniform black, with a single white ornamental spot, and white or black below. These differences in coloration and ornamentation belong to a single species, which, as Günther says, "is only too common all over the continent of the Indian region."

The only relatives of this animal are the *Naja sputatrix*, a black, unornamented form, and the asp (*Naja haje*) of the Egyptian divinities, an animal found in northern Africa, and called by the residents *Spurge-sehlang*, because of the peculiar habit attributed to it of forcibly ejecting its venom, which may often reach the object of the serpent's anger, though it be some little distance away. Mr. Cumming, the African explorer, speaks of suffering great pain from the poison which one spat in his eye. That this is an ordinary habit of the snake is rather doubted by some naturalists. The asp is described as being generally slow in its movements, though, when irritated, it flies at its adversary, defending itself with great energy. It is a good climber, and quite often is seen in the water, where it is perfectly at home, which habits are those of the cobra, an animal which it resembles also in coloration and size.

Of snake-charming, of snake-charmers, and of Indian jugglery, a volume might be

written. It seems certain that cobras of the most poisonous nature are handled with impunity by itinerant jugglers, and it is also a fact that not uncommonly the reptiles are rendered harmless by having their fangs extracted. So-called jugglers have been known to capture cobras while they were in their native retreats, and have not been injured, while others, more unfortunate, have been bitten and only saved from death by the prompt administration of some plant, or, to them, charmed stone. The truth about the matter seems to lie in the fact that the cobra, like many innocent snakes,



FIG. 219. — *Ophiophagus elaps*.

will permit itself to be handled in the roughest manner, provided no sign of fear is shown by the person so performing. Perfect confidence and conscious ability will work wonders. It is a peculiar fact, and one that has been paralleled in several American serpents, that when a cobra is destroyed, its companion will soon appear. Pliny, in speaking of this trait, says that between the male and female an affection exists, and if one is killed the other endeavors to avenge its death.

Ophiophagus elaps, though being provided with an expansion of the neck similar

to that of the cobra, has also around the occipitals three pairs of very large shields, which are characteristic of the genus; it is further peculiar in having a single small tooth behind the fang. We are now dealing with the most deadly of animals, a form, the bite of which will produce the death of a human being in three minutes, and that of an elephant in two hours. Were it as abundant as the cobra it would soon depopulate the country, but the *Ophiophagus* is a rare snake, though of wide geographical range. It has been captured in India, Java, Sumatra, Borneo, and other neighboring islands, and is not only the most deadly, but the largest of venomous, colubri-form ophidians, specimens having been known to reach the length of fifteen feet. A specimen from India, exhibited before the Linnean Society of New South Wales, measured 142 inches in length. As its name implies, the *Ophiophagus* lives on other snakes, which, as it is very strong and active, as well as possessing such virulent qualities, it has little trouble in overpowering. It is often arboreal in its habits, spending a portion of its time hid away in the hollows of decayed trees. It presents as great a diversity of color arrangement as does the cobra.

The genus *Dicmenia* includes several Australian forms which have fifteen or seventeen rows of smooth scales; the fangs provided with anterior grooves, and followed, posteriorly, by a series of smaller teeth. A few of the forms, when adult, are very dangerous. The gray-snake, *D. reticulata*, reaches a length of thirty inches, and is uniformly gray above and greenish below, the underlying skin being black. The eye has two circles, one of black and the other of yellow, surrounding it. Members of the genus are very abundant throughout the Australian continent, with the exception of the extreme north and south, and offer an excellent illustration of the little value that can be placed upon color as a distinguishing character among reptiles. A snake, after shedding its skin, has a much different color from that before exuviation. The gray-snake frequents sandy plains, where it captures small reptiles, and where it also deposits its eggs, sometimes to the number of twenty. It is ordinarily between two and three feet in length, and though some of its congeners are poisonous its bite is said to cause but little irritation. During the cold season, as the gray-snakes are extremely susceptible to frost, they retire, sometimes several together, beneath flat stones, which are daily warmed by the sun, and there remain semi-torpid, often for several weeks at a time. *D. superciliosa* is nearly double the size of the gray-snake, with which it is very generally distributed, though it prefers more rocky localities, where, not infrequently, it proves a dangerous animal. Though the adults retire into the ground during the cold season, the young are found, as are those of many other snakes, under stones and logs throughout the year.

The north Australian *Pseudonaja nuchalis* has the smooth scales arranged in seventeen rows, along the back and sides, while on the non-distensible neck there are two or four more. Behind the fangs there is a series of five or six small teeth. The general color of this rare animal, which sometimes reaches the length of nearly six feet, is brown or blackish-olive, with darker cross-bars, of which the first is of the most intense shade, being in some old forms, the only persistent ornament.

We now come to the genus *Elaps* which, though represented in Africa, South America, and the East Indies by many species, in North America there is but one, which, however, has several varieties. The *Elapides* are characterized by having the head rounded and depressed, and not separated from the body by a distinct neck; the muzzle is short and broad; the fangs stand alone in the upper jaw; the scales are smooth, and so colored as to form bands of the brightest shades of black, red, or yellow,

from reference to the arrangement of which the several North American species can be determined. *Elaps fuleus*, the harlequin-snake, or 'viper,' has the first broad ring behind the occiput black, and all subsequent rings separate, and not united into groups. The head and tail are ringed with black and yellow, while the body combines with these colors a most deep and intense red, the yellow serving as a narrow border for the black. Its habitat is the southern United States and Mexico, though the species is continued still further south by varieties, of which there have several been recognized.

The harlequin-snake is often found below ground, and especially in sweet-potato



FIG. 220. — *Elaps corallina*, coral-snake.

fields, where they are frequently dug up by the laborers. From their ordinary mild disposition they are considered by most people as perfectly harmless, a strange fact when we consider the habits of its more southern congener, *E. lemniscatus*, a most dreaded reptile of Brazil. *E. euryzanthus*, the Sonora harlequin, has the first hood-ring behind the head of a deep red color; it inhabits the Sonoran region, or that portion of south-western United States and northern Mexico which includes a part of Nevada, New Mexico, Arizona, and Sonora in Mexico. *E. laticollaris* is found in the neighborhood of Pueblo, Mexico, and is characterized by having the black rings arranged in groups of threes, and the occipital band yellow. *E. elegans* and *decoratus* also inhabit Mexico; the first has the occipital band black, while *decoratus* has it red.

It should be borne in mind that there are perfectly harmless snakes that have the general coloration of the *Elapides*, though belonging to the previous sub-order. By those unfamiliar with their nature these harmless forms are also called harlequins.

Allied to the harlequin-snakes is the genus *Bungarus*, the several species of which inhabit India. The generic title is a so-called Latin form of the vernacular name, bungarum. The representatives are terrestrial forms, living chiefly on small mammals and reptiles, for which they are continually searching during the day, though they avoid the direct rays of the sun. They are shy, and invariably seek a retreat on being surprised, though they are active on being attacked, defending themselves with great

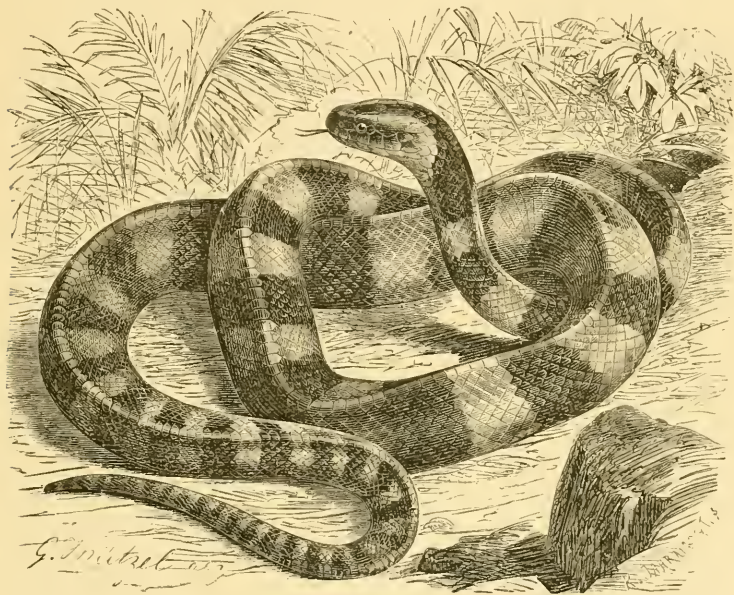


FIG. 221. — *Bungarus fasciatus*, bungarum.

vigor. Their bite is extremely dangerous, though the degree of its virulence depends on the age of the reptile, as well as on the size and position of the wound. As the fangs are short, the abrasion can generally be excised or cauterized, which should always be done immediately, though the dangerous symptoms are not likely to show themselves until the lapse of considerable time. The largest *Bungarus* reaches a length of four feet, and inhabits Java, the Malay Peninsula, Penang, and portions of China. It is known in science as *B. fasciatus*, and much resembles *B. ceylonicus*, which is abundantly found in the island from which it receives its specific name. From the stomach of this Ceylon species, specimens of *Uropeltis* have been taken.

Hoplocephalus includes nearly twice as many species as any other Australian genus.

The several representatives are viviparous; have their scales smooth and arranged in from fifteen to twenty-one rows; the head not separated from the neck; and the sub-caudal scales entire. *H. curtis*, the brown-banded snake, is the most dangerous Australian reptile, its bite being known to kill an animal the size of a goat in about an hour's time. There is a peculiar fact worthy of mention in regard to this animal. Though its bite proves so immediately fatal to animals generally, to itself or to any other highly venomous serpent the poison has no effect. If the reptile could be poisoned by its own venom, the slightest scar in its mouth would soon become inoculated, and death would result, the animal soon becoming extinct. Experiments of a similar nature on other venomous snakes would reveal many interesting facts. The brown-banded snake is very widely distributed over Australia and the neighboring islands, and sometimes grows to be of considerable size, specimens five or six feet in length being sometimes captured. The coloring is variable, ranging from gray to black and with or without distinct bands; the abdomen is ordinarily of a yellow color. The younger forms have the bands much more distinct than the adults, and the Tasmanian specimens have the belly spotted or clouded with gray. Thirty or even more young are brought forth in a season by a single pair, the young presenting as much variety of marking among themselves as do the adults. At the beginning of cold weather all retire into the ground, from which they do not emerge until the temperature is once more suitable. This reptile, together with other large and venomous Australian snakes, has the peculiar habit, when excited or irritated, of raising the anterior portion of its body and spreading its neck, thus assuming the appearance of the cobra of India. Other species which have this habit are *H. superbus*; the black-snake, *Pseudechis porphyriacus*; and the orange-bellied snake *P. australis*.

The large-scaled snake, *Hoplocephalus superbus*, is easily distinguished from its congener, *H. curtis*, the only form which equals it in size, by the shape of the middle cervical plate, which is oblong, that of the previous species being almost square. The present species, moreover, has the scales of the back and sides in a less number of rows, there being but fifteen, while *H. curtis* may have even nineteen. Specimens have been captured which had markings on the back of the distensible neck which strongly resembled those of the cobra, though ordinarily the snake is unornamented, being of a plain copper color. Like the previous species, the large-scaled snake prefers marshy localities, frequenting extensive reedy swamps or river banks, where it captures frogs, lizards, and small mammals. It inhabits Tasmania, as well as southern Australia, on the island being known as the diamond snake, a fact that has been mentioned in connection with the Australian 'diamond,' *Mordia spilotes*. *H. variegatus* is extremely limited in its distribution, being only found in the immediate neighborhood of Sydney where it is known as the broad-headed snake and reaches a length of three feet. Being a nocturnal form, it is, though abundant, seldom met with by the collector, except under flat stones, where they hibernate during the cold season. It frequents the open scrubby country and is also quite abundant along the coast line of the south-east. Its poison is not of a sufficiently virulent character to produce any serious results to larger animals. Mr. Gerard Krefft, who has done more to elucidate the study of the Australian reptiles than any other naturalist, says: "If a person be bitten by one of them, the simple act of sucking the wound is sufficient to avert any unpleasant sensation; but should nothing be done, a violent headache, a certain stiffness in the spine, and some local swelling is generally the consequence. It takes from thirty minutes to an hour before these symptoms set in." Closely resembling this species, but differ-

ing from it in having the ventrals deeply cut out on each side, is *H. stephensii*, which inhabits the neighborhood of Hastings River. *H. coronoides* is peculiar to Tasmania. *H. nigrescens* is unique in having the tongue white. Though first only found around Port Jackson, it has since been obtained from points along the coast further north. It is closely allied to *Vermicella*, like which ophidian it allows itself to be handled without offering resistance.

Tropidechis carinata resembles in many points the members of the previous genus, but has the scales keeled, which peculiarity, with others, gives it the appearance of some harmless *Tropidonotus picturatus*, from which animal, however, it can be easily separated by counting the number of rows of scales, the venomous snake having twenty-three rows, while *Tropidonotus* has only fifteen.

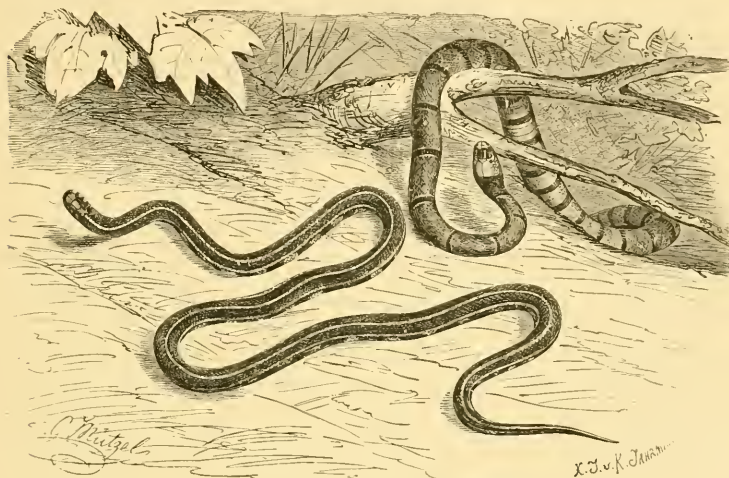


FIG. 222. — *Callophis macellandi* and *C. annularis*.

It has been noticed that venomous snakes often have the temporal shield inserted between the two last upper labials; this arrangement is illustrated by the genus just treated.

The genus *Pseudechis* has the scales arranged in seventeen rows, the anterior subcaudals entire, while the hinder ones are generally divided; behind the grooved fangs are smaller simple teeth. The first species, *P. porphyriacus*, a black snake, grows to a length of six feet and is the most common Australian venomous snake, and was first classified with the cobras by the early writers, being, as already said, one of those ophidians which on irritation expand the skin of the neck. It is fond of moist localities, and is quite active when in the water, where it catches frogs, insects, and small mammals; as many as sixteen young water-rats (*Hydromys leucogaster*) have been taken from its stomach. The bite is extremely venomous, soon producing the death of a fair-sized animal. It is found all over Australia, but has never been captured in Tasmania.

The *Callophides* are characterized by the small number of scale rows, there being only thirteen, and by the grooved maxillary fang standing alone. The several species are very similar to one another. The head is of moderate length, and not separate from the body; the cleft of the mouth is but little extensible, and the scales of the body are smooth and polished. The genus is restricted to British India, and the members are more abundant on the continent than in the Archipelago. They represent the American *Elaps*, the African *Homorelaps*, and the Australian *Vernicella*. They are thus terrestrial forms, preferring the hilly countries to plains, and are of slow and sluggish movement. In their general form they closely resemble the abundant Calamaridae, on the members of which genus they chiefly feed; the venomous reptile being able to overpower the non-venomous. It is a strange fact that the distribution of these two genera is over the same geographical area, and, though both are abundant in India, a specimen of neither genus has ever been found in Ceylon. The sight and hearing of *Callophis* is extremely defective, making it an easy matter for the collector to secure them. Though they can only be induced to bite after considerable agitation, they are nevertheless very poisonous, and the greatest caution is necessary in collecting or handling them. Animals inoculated with the venom have died in from one to two hours, though the small fangs and scanty supply of poison renders it quite easy, in case of accident, to prevent any fatal results, provided only that the proper remedies are at hand.

One of the most beautiful of Australian ophidians is the scarlet-spotted snake *Brachysoma diadema*. Its general color is brown, each scale having a yellow spot in its centre, and the neck, which is distinctly constricted, is surrounded by a bright scarlet collar. While the scales of this species are disposed in fifteen rows, those of *B. triste* are in seventeen. The genus *Vernicella* has the head like *Elaps*, and a pair of minute grooved fangs, without any other teeth in the upper jaw. These characteristics connect it, as well as allied Australian forms, more intimately with the *Elapides* of the western than of the eastern hemisphere. *V. annulata* is called by the native collectors the black-and-white ringed-snake, and inhabits nearly every part of the insular continent. It is at once recognized by the alternate black and white rings, which encircle the body, and by its peculiar dentition.

The arrow-headed Dendraspis, *Dendraspis angusticeps*, is an inhabitant of South Africa, and is quite abundant at Natal. It is long, sometimes reaching six feet, slender, very active, and a good climber. Its color is olive brown, with green above and a paler shade below. Much different in form is the death-adder of Australia, known to science as *Acanthophis antarctica*. Its popular name is most characteristic, as it is a very dangerous reptile, being provided with long immovable fangs, and possessing venom of a most dangerous character, though not so virulent as that of the cobras or rattle-snakes. A frog severely bitten by a large death-adder has been known to live more than twelve hours. The peculiar tail, the terminal portion of which is compressed, and covered with enlarged scales, the last being formed like a thorn, though it only becomes hard in old individuals, is neither an instrument of offence or defence, though the natives suppose it to be a most effective instrument of death. It is from this peculiar appendage that the generic name has been given.

The genus *Denisonia* is peculiar in having — though it is a poisonous snake — a loreal shield, an ornament which is usually characteristic of innocuous ophidians. It is a rare snake, of only ordinary size, inhabiting Queensland.

The family HYDROPHIDÆ, or sea-snakes, includes a group of highly specialized

ophidians. The elongated body, though sub-cylindrical anteriorly, is posteriorly compressed, the tail often being shaped like a broad paddle. To bring about this structure, the caudal vertebrae are compressed, and their vertical processes elongated. The head is rather 'indistinct' in most of the forms, and bears the valvular nostrils, except in *Platurus*, on the upper side; the eyes are small, with a round pupil; there is no loreal plate, and the general scutellation of the head is regular; the body scales are small, and may be keeled or tuberculate; the fangs are of ordinary size, erect and grooved, and followed by other teeth of simple structure. The members of the family inhabit the tropical portions of the Indian and Pacific oceans, and sometimes enter fresh water. All are purely aquatic, spending their whole life in the water, out of which they appear to be blind and soon die (*Platurus* may be an exception to this statement, as it offers many structural characters opposed to the other Hydrophiæ). In their general form the sea-snakes are most admirably adapted for their aquatic life. The compressed body and paddle-like tail not only point to this, but the belly is not rounded as in other ophidians, but sharp, like that of a herring. The ventral scutes, moreover, not being of value for aquatic locomotion, are not specialized, or, if so, only in a mild degree. The tail, though shaped like that of a fish, is at the same time prehensile, enabling the animal to rest by winding it about some half-submerged root or piece of coral. The nostrils are so provided with valves, that when the enormous lungs have been inflated, they can be tightly closed, and the animal, with its supply of air, can either dive below the surface or rest motionless, being buoyed up by having its specific gravity thus diminished. The position of the nostrils is such as to enable them to breathe without protruding more than the tip of the snout from the water. The armament of scales has been seized upon by the naturalist as offering a means of classifying the several species. While a few have the scales imbricated, like those of terrestrial serpents, the majority have them merely juxtaposed, and often lose their horny covering and become tubercular and soft. The shields of the head (except in *Platurus*, which form is generally exceptional), are so changed as to often lose all resemblance to those of ordinary ophidians. In shedding their epidermis, the sea-snakes resemble the lizards, only a small portion being exuviated at a time. The eye of the sea-snake is so weak that, when the animal is taken from the water, all its attempts to strike prove ineffectual. The mouth is so closed by a development of the rostral plate, as to ordinarily prevent the entrance of water, though in some forms there are two small openings for the extrusion of the bifurcated tongue. The family possess poison of the most intense virulence, by which they obtain their food, which consists exclusively of fishes. These they seize and sting, the poison affecting the unfortunate animal so that it almost instantly dies, and in a relaxed condition, so that the serpent, in swallowing them, as it does, head first, has no inconvenience from the otherwise erect and rigid spines and barbs with which many pelagic fishes are armed. Though naturally shy, the sea-snake will, when attacked in its native element, dart at the intruder with all the vigor of the indignant terrestrial forms; but when drawn up in nets they are apparently helpless, the fishermen picking them up and throwing them back into the water with the most surprising unconcern. Many experiments have been made to keep the sea-snakes in aquaria, but they invariably die in a few days. All the forms are viviparous, the young, sometimes to the number of nine, being active swimmers from the first. The adult males may be easily distinguished from the females, as they have on each side of the tail an area which seems to be considerably swollen. The natural enemies of the sea-snakes are the eagle-rays and rapacious

sharks. Specimens of eight feet in length are common, while there is a single instance of one measuring twelve feet,—far too small, it will be seen, for the sea-serpent of the newspaper.

The genus *Platurus*, though found upon the high seas, has so many points of structure in common with the terrestrial, as well as at variance with the marine, serpents, that its position is that of a connecting form uniting the Elapidae with the Hydrophidae. The sub-cylindrical body, the smooth, imbricate scales, the well-developed ventral scutes, the divided sub-caudals, as well as the general physiognomy,—the cleft of the mouth being horizontal, while other sea-snakes have it turned up posteriorly—are characters which answer equally well for the members of the previous family. The scutellation of the head is quite regular; there are two pairs of frontals, seven labials, no loreal, and the nostril is lateral, a position unique in Hydrophidae, and pointing to a partly terrestrial life, though positive information as to this habit has not been obtained. The poison fang is small and generally stands alone, though occasionally a small tooth can be found some little distance back. *Platurus scutatus* inhabits the Indian seas from southern India and China to New Zealand. It sometimes reaches a length of five feet. *P. fischeri* is a smaller form, having a geographical range of less extent, and is not found on the southern shores of Australia, though it extends further east, having been observed near the New Hebrides.

The genus *Aipysurus* is found around Australia and the neighboring islands. It has the body compressed, the cervical scales divided, the nostrils opening superiorly, and each surrounded by a nasal plate. The scales are of moderate size and may be either smooth or tuberculate; the ventral scutes are well developed and have a longitudinal median ridge; the sub-caudals are undivided. *A. anguillaformis* inhabits the Javan seas and reaches a length of two feet. The upper parts are brownish, ornamented with cross-bars of yellow, and the tail is terminated by a large shield-like scale. *A. levis* has the terminal scale very large, and is of a uniform brown color, inhabiting the seas around New Caledonia and New Guinea, where it sometimes reaches the length of five feet. *Emydocephalus* inhabits the Australian seas and is characterized by having the ventral shields large, and with only a slight median ridge, the labials are reduced to six, and the imbricate scales are tuberculate. The tail ends in two large denticulated scales. The tortoise-headed ringed sea-snake, *Emydocephalus annulatus*, reaches a length of thirty inches. The head is covered with rounded plates, and the body is encircled by thirty-five black and as many more white rings. *E. tuberculatus*, the tortoise-headed brown sea-snake, is about the same size as its congener, but differs from it in having a longer head, larger and more tuberculated scales, and in being of a uniform purplish brown color, mottled with lighter spots along the sides. Of *Disteira* but a single specimen has been taken, the locality of which is unknown. It has the nasal shields separated by the frontals; and the ventral shields, though narrow, are distinct. *A. calypus* is also an extremely rare ophidian, inhabiting the southwest Pacific; only two specimens are known. In length it measures about two feet.

Much different is the distribution and abundance of *Hydrophis*, a genus characterized by having the head of moderate length and well provided with shields, and the lower jaw without an anterior notch. There are enumerated of this genus as many as thirty-five species which are easily determined by reference to their general form and armament, the shape of the head, and the arrangement of the cervical plates.

Hydrophis cyanocincta, the form selected for illustrating the genus, is popularly

known as the chittul, and is characterized by having the scales faintly keeled, the ventrals broad, and the terminal scale of moderate size. Its color is greenish olive above, shading into yellow below, and decorated with from fifty to seventy-five black cross-bars, which in young specimens surround the body, though the adults generally have the ventral portions obsolete. It is one of the most common sea-snakes, being found south and east of Asia, and among the islands of the archipelago. It reaches a



FIG. 223. — *Hydrophis cyanocincta*, chittul, sea-snake.

length of six feet. *H. stokesii* is also a large form, an old female having been known to reach the length of sixty-one inches, and a height of four and a half. It is an abundant snake on the northern shores of Australia, though its more extended distribution is uncertain. The adults are of a uniform grayish color, shading into white below. *H. robusta* is a form which has caused considerable confusion among naturalists. It is large, ornamented with as many as thirty-five black rings, and is found in the waters at the south of India, as well as among the islands of the archipelago.

The eyed sea-snake is a beautiful animal inhabiting the Australian seas; it is known

to science as *H. ocellata*, the specific name being given because of the eye-like spots along the sides and ornamenting the back.

Of the family of Hydrophiidae no representative has a wider distribution than the yellow-bellied sea-snake, *Pelamis bicolor*. It not only inhabits the Indian Ocean, but has been captured on the coast of Madagascar, as well as on the west shores of America and as far south as New Zealand. On the Australian shores, numerous specimens are stranded during gales; the females, on dissection, have been found to contain as many as six young, these often of considerable size. In the Australian seas it is by far the most abundant representative of the family. It might be expected that a species so cosmopolitan would offer many varieties in minor points of structure and

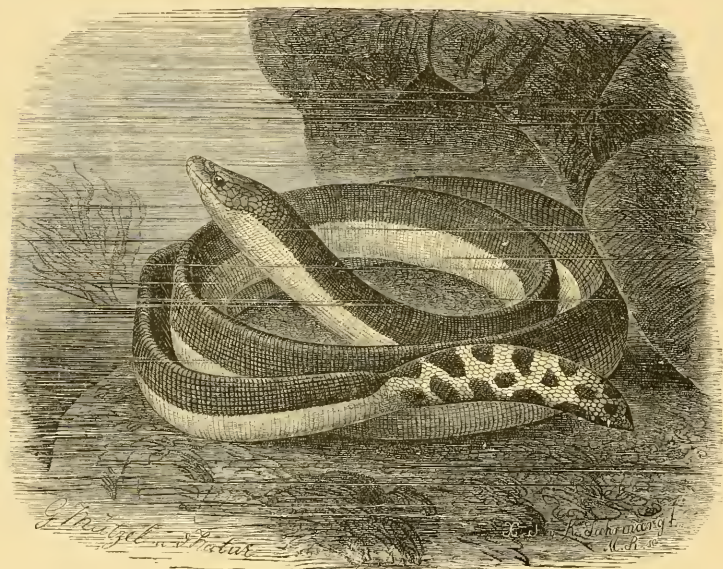


FIG. 224. — *Pelamis bicolor*, yellow-bellied sea-snake.

coloring, and this is the case. The first variety has the upper part of the head and body of a uniform black, and the belly brownish olive, the tail with black spots. These colors may be separated by a lateral line of yellow, which, in other varieties, may gain possession of the lower portion of the body, or infringe regularly or irregularly upon the black of the back. The length of three feet is not exceeded.

SUB-ORDER IV.—SOLENOGLYPHA.

The fourth division of ophidians has been subdivided into two groups, the basis for the subdivision being that, while the Old World representatives resemble those of

the western hemisphere in general form, habits, and in the effect of poison, they, as a rule, are different in not possessing a deep pit on the side of the head, between the eye and nostril, very characteristic of the American forms, or *Bothrophera*, and are hence distinguished as *Abothrophera*.

The fangs are the only teeth of the maxillaries of the *Solenoglyphæ*, which bones are so attached to the lachrymal and frontals as to allow considerable motion, that the fangs, except when about to be used, may lie against the jaw, where they are covered by two folds of tough membrane. Immediately behind the slender fangs, which are not only often broken off, but are regularly shed, are several incipient teeth, which, though only attached to the gum, are regularly pushed forward, and take their position as new fangs when the old ones are lost, becoming firmly attached to the maxillary bone. These fangs are perforated by a canal, which is quite evidently, on viewing the teeth in cross section, a mere fold of the anterior part, the lateral ridges being united together from near the base of the fang, where opens the venom duct, to a point a little above and in front of the apex, where it opens by a small slit. The venom gland, which is a modified salivary gland, varies greatly in size; in all cases, however, it contains a cavity where the poison is reserved until it is ready for use. Below and around this gland are a series of muscles, which, by voluntary contraction, can project the venom through the duct, down the canal of the tooth, and can throw it further, as a small jet, for some little distance. It has been often stated that the venom must, of necessity, be ejected by the pressure of the muscles, as the reptile strikes. This is not the case, however, as the serpent can, at will, control the flow of venom, and may even strike without poisoning the object of its anger; moreover, a thoroughly exasperated snake, when held by the neck, has been known to forcibly eject the venom, though no opportunity was given for striking. When, however, the animal is surprised in its native haunts, if no retreat is offered, it collects itself, so that the anterior part of the body can be straightened, and, on being further irritated, may strike with the mouth open and the fangs depressed, or it may erect the fangs and wound, or it may strike with the mouth closed, the fangs projecting as tusks on each side of the lower jaw. On the fangs entering the flesh, the snake, by throwing its head forward, makes a small cavity in front of the venom orifice, which receives the poison when the teeth are withdrawn. When small animals, intended for food, are thus wounded, they appear paralyzed, the snake watching them most intently, an action which has, to some people, substantiated the foolish notion of charming. As the venom is an active decomposing agent, it undoubtedly assists in digestion. It is an interesting fact that the members of *Solenoglyphæ* are viviparous.

The symptoms exhibited by persons who have been bitten by our more poisonous snakes seem to vary considerably; but it is probable that the poison, entering the blood, paralyzes the nerve centres, seriously affecting the function of respiration, and enfeebling the action of the heart. The venom, when taken into the alimentary tract, is harmless, as it is incapable of passing through the thick mucous walls, and its nature is more or less changed by the action of the digestive fluids. But through other tissues of the body, as the serous or muscular, it rapidly spreads; the blood thus affected being materially changed, and after death losing its natural coagulability.

The first thing to be done, on receiving a wound from a poisonous serpent, is to tightly tie a broad ligature between the part wounded and the heart, that the venom may be, only little by little, admitted into general circulation. The next thing is to enlarge the wound and suck from it the blood and poison. Spirits should be freely

given, that the weak action of the heart may be kept up, and finally, but as soon as possible, there should be injected directly into the wound a one per cent solution, in water, of potassa permanganas, a chemical antidote discovered by Dr. Lacerda, of Rio de Janeiro, and found to be very effective.

The first representative of the sub-order of which we treat is the *Atractaspis irregularis*, of southern Africa, a form the habits of which are little known. Though a small serpent, seldom exceeding two feet in length, it has the fangs developed in a most extraordinary degree, being so long as to reach back to the angle of the jaw. That this snake can strike as do other members of the sub-order is much doubted by

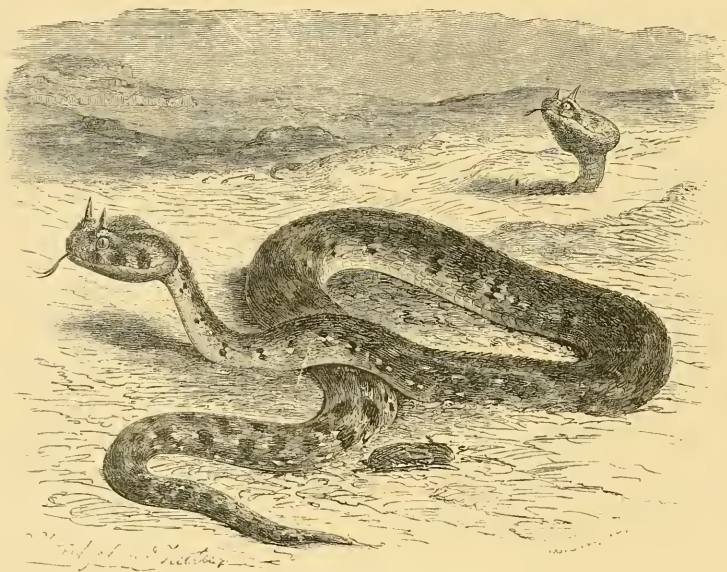


FIG. 225. — *Vipera cerastes*, horned-viper.

some, as the fangs seem to fill the mouth in such a way as to prevent their apices from being protruded.

The vipers have the body robust, the tail short and not prehensile; the head triangular and generally covered with scales, or at least incompletely shielded; the eye is of moderate size, and is provided with a vertical pupil, and in front of it there is no depression or pit so universally characteristic of the Bothrophera. The vipers, some of which grow to a considerable size, are inhabitants of Africa, and from their virulent nature have been known since time immemorial; the most common is the *Vipera cerastes*, or horned-viper. This animal, though not so poisonous as the cobra, is extremely dangerous. In its appearance it is a most repugnant animal, of a pale brownish-white color above, with spots and blotches of a darker shade. Over each

eye is a scaly spine or horn, which is supposed, by the ignorant natives, to be possessed of the most wonderful virtues. Though its home is in the hottest deserts of north Africa, where it lies half buried in the sand, awaiting the arrival of its prey, it can endure severe cold and prolonged hunger; the latter, however, might be expected from its habits. Specimens have been kept in confinement upwards of two years without taking any nourishment, though they sloughed their skins at regular intervals, showing that they were in a healthy condition. To this species has been attributed the questionable honor of producing the death of Cleopatra.

The asp, or *Vipera aspis*, has a wide distribution over Europe, extending north into Sweden, as the only boreal poisonous reptile. The bite of this ophidian is much

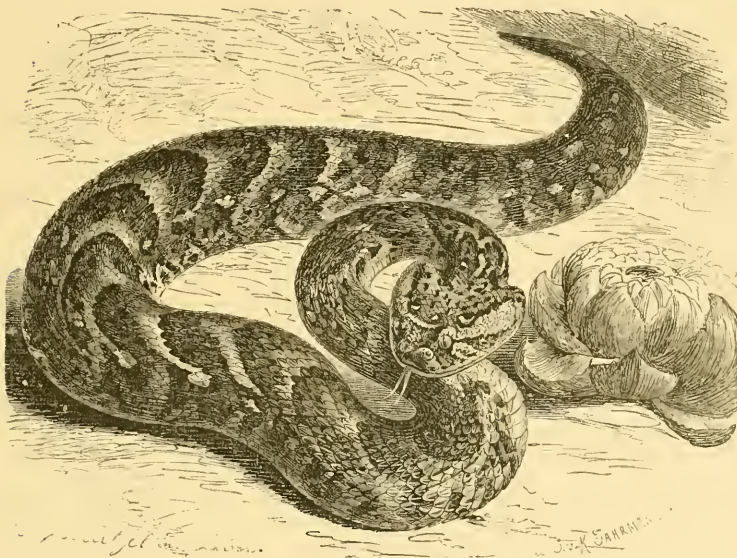


FIG. 226. — *Clotho arietans*, African puff-adder.

dreaded, for, though it only rarely produces death, it is very painful, often inducing the victim to amputate the affected part rather than endure the pain or run the risk of possible death. The viper or adder, *Pelias verus*, is the only venomous reptile known to inhabit England, where, as has been already stated, it is often mistaken for the grass-snake, which, in turn, is not infrequently mistaken for the adder. They are easily distinguished, however, as the poisonous reptile has a zig-zag chain of dark spots running along the back, which are not present in the innocuous form. The ground color of the viper is, moreover, generally of a greenish-olive or brown, though specimens of a yellow, a brick-red, or a black color have been captured. To this species, as is the case with many other poisonous reptiles, the habit of swallowing or partially swallow-

ing the young, in the apprehension of danger, has been attributed. Though the people who are willing to swear that this is an ordinary occurrence are numerous, they are, nevertheless, often uneducated; the fact that not a single naturalist of good standing has ever observed the trait, though many have been their endeavors, seems to cast considerable shade on this case of parental oversight. The poison of this animal must be of a very strong nature, for though it is only in the minutest quantity when compared with that of such animals as the rattle-snake, it is capable of producing the most severe symptoms, which sometimes last for days. During the cold season the adders, like the American copper-heads, congregate together, often entwining themselves into a ball of the most repulsive appearance.

The African puff-adder, *Crotho* or *Echidra arietans*, has received its popular name because of its habit of swelling or puffing itself up when irritated. It is both the largest and the most poisonous reptile of South Africa, not infrequently reaching a length of over four feet, and while other poisonous snakes are sufficiently active to endeavor to escape on seeing an intruder, the puff-adder is so consummately lazy that, rather than move or make itself known, it will remain, half buried in the hot sand, with its sullen eyes fixed upon the unsuspecting traveler with a most freezing glare, and if irritated in the slightest way, it starts up a hissing, which is followed, if the animal is further approached, by a most deadly attack. It is with the poison of this animal that the Bushmen arm their most effective arrows. In collecting these serpents they are said to walk up to the sullen animals, and before the snakes have fairly made up their mind to strike, plant the bare foot upon the neck and sever the head with a small knife. The color of the reptile is brown, variously ornamented with spots of gray or white. *Crotho nasicornis* is also an inhabitant of Africa, where it has received the name of river-jack. The male is peculiar in having a spine, protected by scales, projecting from the upper side of the nose, between the nostrils. *II. cornuta*, or the plumed-adder, as it is called, derives its name from the peculiar plume-like structures which appear over each eye. Though short and stout, it is very beautifully ornamented, the body being marbled with chestnut, and punctate with numerous small dots; along each side of the vertebral line are two rows of dark blotches.

Of the Indian vipers there are but two kinds, *Daboia russellii* has the nostrils very large, laterally placed, and surrounded by three shields. The head is covered with scales, those of the sides as well as those of the body being keeled. The general color is brown, with three rows of large white-edged rings, of which those of the middle of the body are largest; the lower side is yellow, and in some cases marbled with brown. The *tiepolonga*, as this species is called by the natives of Ceylon, inhabits not only that island, but also India, as far as the Himalahs. It is a most common terrestrial reptile, and is much dreaded, being nocturnal in its habits. It is sometimes fifty inches in length, feeds on small mammals, and has been named by the Europeans, because of its venomous nature, the cobra monil.

The other Indian viper, *Echis carinata* is structurally different from the previous species, in that the sub-caudals are simple, and the nostrils are small, and situate in a large, posteriorly divided nasal. The small keeled scales of the head are imbricate, two rows of which are between the eye and the labials. It differs chiefly from its African congener in having a fewer number of ventral shields. *E. carinata* is common in many parts of India. It never exceeds a length of twenty inches. Being such a small snake, its bite is not known to have ever proved fatal, though some authors speak of it as a most virulent form, requiring a double dose of medicine to

counteract the effects of its poison. *Trimeresurus* (including *Rorias*, and *Megara*), embraces those vipers which, from their green color and prehensile tails, are fitted for an arboreal life. They are provided, as are the remaining genera of the sub-order, with a small pit in front of the eye, which indicates the lachrymal fossa of the American Crotalidæ, of which they are the Old World representatives. The members of the present genus are naturally of a sluggish disposition, remaining for hours at a time resting along some branch, which they resemble so closely in color as to attract no attention until they have made their presence known, either by a warning hiss, or by immediately biting. Though their ordinary small size generally prevents the bite from proving dangerous, some of the larger specimens may inflict wounds which result in death. Ordinarily, however, the symptoms, though severe, are confined to nausea and fever, seldom enduring for any long period. The pain and swelling having subsided, the neighborhood of the wound becomes black and mortifies, and is finally thrown off, after which the patient soon recovers his former strength. The animals ordinarily feed on birds and mammals; other ophidians as well as lizards being rejected.

Trimeresurus trigonocephalus is a good representative of the genus. It is an inhabitant of Ceylon, where it leads an arboreal life, and reaches, when adult, the length of thirty-one inches, of which the prehensile tail is about one sixth. The color is green, with a network of black stripes on the head, which is produced backwards as a median dorsal line, sending alternate lateral branches to the sides. The lower surface is pale green, marbled with blackish posteriorly.

Peltopeltor has but a single representative, *P. macrolepis*, an animal inhabiting the Anamallay mountains, and reaching a length of twenty-one inches. It has a large pit in the loreal region, the body with twelve series of large, keeled scales, and the head with small, imbricate scales. Its color is of a uniform green, brighter below, with lateral lines of bright yellow.

Calloselasma is also represented by a single species. It has smooth scales, the head protected above by cervical plates of the normal number; and the tail, which is not prehensile, terminated by a long spine-like scale. *C. rhodostoma* inhabits Java and Siam. Though only attaining a length of three feet, a single specimen has been known to cause the death of two men in five minutes.

Hymale nepa, the only representative of its genus, is found in southern India and Ceylon, where it is known as the carawala and is greatly dreaded, though its poison does not prove fatal until it has been in the system for several days, there being therefore every hope, provided the proper remedies are only applied in time. Like the other viperine snakes, it is viviparous, the young, five inches in length, having been dissected from the female. The animal has the shields of the snout scale-like, while the other cervical shields are normal.

We now come to those Solenoglyphs which are distinctively New World, and are included under the head Bothrophera, the several genera of which have not only the peculiarities of structure already mentioned in the introductory remarks to the sub-order, but also the following: The general form of the body is stout, and the large, flat, triangular head well separated from the body, which latter is either terminated by a series of so-called rattles, or may be of the ordinary cylindrical form; the pupil is elliptical, its longer axis being vertical; between the eye and the nostril is a deep pit, which characterizes the group, though some ophidians of the eastern hemisphere have a somewhat similar depression. The venom glands are behind the eye, lying

along the sides of the skull, and open into the tubular fangs. The scales of the body are keeled and the anal scale is entire.

The introductory genus is *Ancistrodon*. It is represented north of Mexico by two species which are alike in having the sub-triangular head distinct from the neck, and the tail short and tapering to a point. There are both frontals and parietals, and the loreal may be present or absent; the scales of the body are arranged in twenty-three or twenty-five rows, and the pits at the side of the face, are well represented.

The so-called highland-moccasin, *A. atrofuscus*, has not been collected since the time of its original description. It and *A. piscivorus* are undoubtedly the same species.



FIG. 227. — *Ancistrodon contortrix*, copperhead.

The copperhead, *A. contortrix*, has an extended geographical range, being found from New England to Florida, and from the Atlantic to the Mississippi, and is popularly known as the copperhead, because of its dark bronze-colored head. Though it is occasionally found in meadows, in the neighborhood of water, searching for mice and small birds, its proper home is in the wild mountainous districts where the pregnant females are known to gather in large numbers and entwine themselves, as do the European adders, into a huge mass of living venom, presenting to an intruder a most formidable appearance. The young, which, like others of the sub-order, are brought forth alive and active, show from the first a most irascible temper, when only a few hours old striking right and left, apparently trying to test the power of their sharp and delicate fangs. The number born of one female is not known to exceed seven. The young probably hibernate with their parents.

The copperhead is of a bronze hazel or light reddish brown above, with a series of transverse, dark brown bands which enlarge on the flanks into blotches. The lower surface is of a flesh color and spotted, as is much of the back, with minute dots of dark brown. Along each flank is a row of dark spots alternating with and between the bifurecations of the dorsal bands. There is a loreal plate, and the scales are dis-



FIG. 228. — *Ancistrodon piscivorus*, water-moccasin.

posed in twenty-three rows. These last characters at once separate the present form from the succeeding, which has no loreal, and the scales arranged in twenty-five rows.

The water-moccasin, *A. piscivorus*, is an animal dreaded by the travelers of the south even more than is the rattle-snake. While the latter only takes the defensive on being irritated, and ordinarily makes its presence known by sounding its alarm, the

moccasin strikes at every object that displeases it, and will even raise its head and spitefully strike at objects some distance away. In confinement, harmless snakes have shown the greatest apprehensions on being placed in company with a moccasin, which, nevertheless, they greatly exceeded in size. The moccasin, like the cobra of India, seems well aware of the power which it possesses, for while the harmless snakes above spoken of were soon attacked and poisoned, on the introduction of moccasins, an understanding was obtained, and mutual respect resulted in perfect harmony. In out-door life, the moccasin, which has for its habitat the southern states from the Carolinas to Texas, is always found in the water or its immediate neighborhood. The reptile is often seen resting upon the low branches of some overhanging

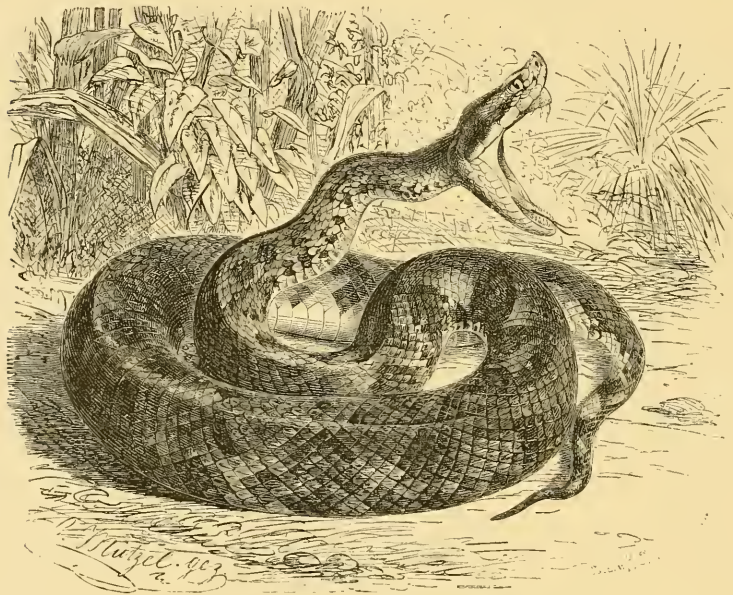


FIG. 229. — *Trigononocephalus lanceolatus*, fer-de-lance.

tree, where it can at once bask in the sun and watch for its prey of fish, tadpoles, frogs and the like, which it has no difficulty in catching, as it is a most active swimmer. The coloring of this species is of an olive shade above, with about a dozen transverse black bars; below, brownish yellow, mottled with dark blotches. It can most easily be distinguished from the preceding species by comparing the cervical plates, and counting the longitudinal rows of scales. The variety *pugnax* is based upon a narrow and crowded second labial; it inhabits Texas. Specimens of the moccasin seldom reach four feet in length.

The genus *Trigononocephalus* includes the most venomous animal of the western hemisphere, the celebrated fer-de-lance, *T. lanceolatus*, of Brazil. This animal being

of a most aggressive disposition, attacking without giving warning, actually abounding in its habitat, growing to a large size, and being of remarkable fecundity, probably causes the death of more laborers in the sugar plantations of South America than any other agent. Its venom is not spent in defence alone, but the fer-de lance being a most voracious animal, it is of value in securing the rats and other small rodents which would, were it not for this serpent, as well as several others, soon overrun and destroy the cultivated districts.

Under the generic name *Caudisona* appear those forms which resemble the true *Crotali*, in that they are provided with the terminal rattle, but they show their intermediate character in that the plates of the head are much like those of *Ancistrodon*. The head is large and triangular and well shielded with frontal and parietal plates, the deep pit is present, but the rattles are but poorly developed and few in number, being only capable of giving a feeble alarm.

Caudisona tergemina, the black rattle-snake or massasauga, is found in Ohio and Michigan, and southward to Mississippi; it has the scales in twenty-three or twenty-five rows, a large pre-orbital, and a small and sub-triangular loreal. In coloring it is light ashy brown or black on the back, depending on the exposure to which the animal has been subjected; those having lived in dry open localities seem to be bleached out. The back is ornamented with seven rows of irregular spots. This animal is often found in the burrows of the prairie-dog, *Cynomys ludovicianus*. *C. edwardsii* is a rare and a beautiful species inhabiting northern Mexico, Texas, and Arizona. The scales are in twenty-three rows, the two outer rows being smooth. The general color is yellowish brown with several series of spots, the dorsal series numbering about forty-two. The belly is light yellowish mottled with brown. *C. miliria* is a very abundant form in the south, where it has received the name of ground rattle-snake, being frequently found among dry leaves and in tangled grass, searching for small field-mice. As it seldom gives any warning before taking the aggressive, it is very much dreaded, especially by the common people, who regard it as even more dangerous than *Crotalus horridus*, but experiments show that its bite is not as virulent; a cat which was severely wounded, recovered at the end of a couple of days. Though the ground rattle-snake has sufficient venom to kill the animals on which it preys, as the towhee buntings, and field-mice, it has not, being but a small reptile, a sufficient quantity to dangerously affect the larger animals. It has the scales arranged in twenty-one or twenty-three rows, all but the outer keeled, and the labials numbering from ten to twelve, the infralabials eight to thirteen. The coloring is generally dark, of an ashy-brown shade, with a dorsal series of from thirty to forty irregular, band-like, black spots with light edges, which become divided towards the tail. Along each flank and also along the belly are three series of smaller spots alternately arranged. The greater number of specimens have a dorsal line of a reddish color. The habitat is along the southern states and Mexico. *C. rava* inhabits the table-lands of Mexico, and is allied to the previous species. It is of a yellowish color ornamented with from twenty-six to thirty deep brown dorsal and an equal number of alternately arranged lateral spots. The head is pale and immaculate, save a very minute punctulation. The species is at present quite rare in museums.

The genus *Crotalus* has the parietal shields scale-like and the frontals either divided or absent; the tail is terminated by a well developed organ, popularly called the rattle. Of this genus there are several species, which number some naturalists have augmented by including the members of the previous *Caudisona*. As now restricted

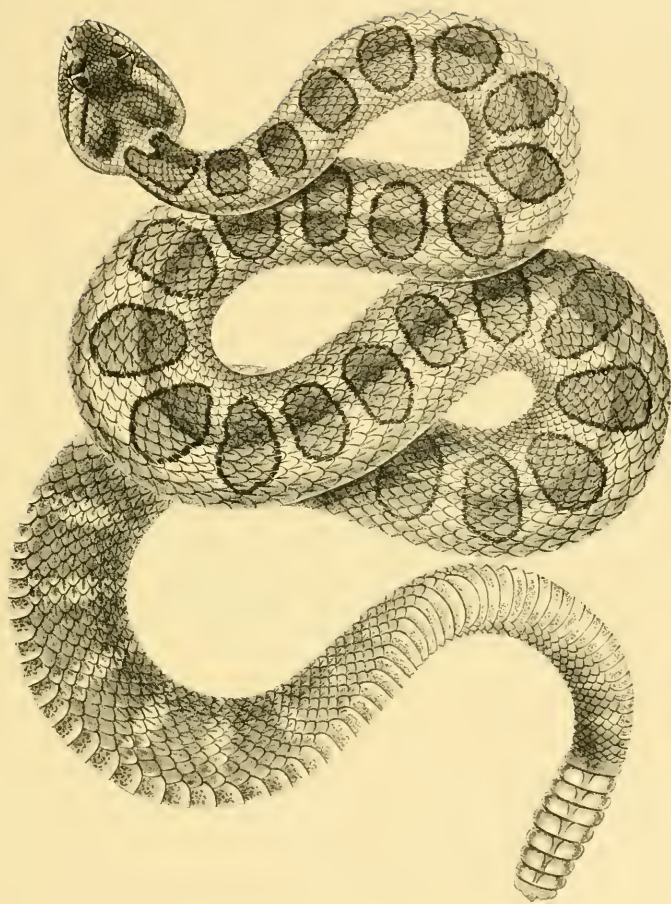
there are about fifteen species, many of which present several local varieties. Although the Australian *Acanthophis* and many members of the genus *Typhlops* have the tail terminated by variously formed spines, the appendage peculiar to *Crotalus* is by far the most interesting, as it is by far the strangest development. As to its use, many have been the theories; some claim that, as the sound resembles that produced by several insects, it is a lure for insectivorous birds, but observation has shown that, while hunting, the snake ordinarily preserves quiet; it is moreover seldom that birds are found, on dissection, to be in the stomach. Equally weak seems the explanation that the sound produced by the rattle so terrifies the smaller animals on which the snake feeds, as to render them helpless and thus easily captured. To many it might seem probable that it is a special organ designed for bringing the sexes together in the mating season, an end which is often gained by other and numerous means, but, while mating, the rattle, though used, is not vibrated with as much energy as it is when the reptile is irritated, and it is here that we find the probable use of the organ. Though ordinarily perfectly able to defend itself, the rattle-snake is, after having repeatedly drawn from its supply of poison, for some little time comparatively helpless, and being rather slow, as well as having a sullen disposition, it would, were not some provision made, suffer from its temporary helplessness. This is prevented, however, by the rattle, which the snake, on being surprised, uses as an alarm, making its presence known, the reptile thus avoiding the undue waste of poison, which to it is an essential means of protection.

The rattle, a most common cabinet curiosity, is made up of a series of depressed horny rings, each consisting of a posterior tongue-shaped portion, which is held in the hollow, cup-like, anterior portion of its succeeding fellow by a terminal knob, the so-called 'button.' It will thus be seen that if a portion of the rattle is broken off, a 'button' will always remain. As such an accident is not infrequent, and since several new joints may be added during a season, the number of rings can in no way indicate the age of their possessor, though we must give up all hope of this fact ever being comprehended by the ordinary local reporter.

The habit of rapidly vibrating the tail, when excited, is possessed by many ophidians, and when it is done while the reptile is in dry leaves, a noise is produced so resembling the alarm of the rattle as to even deceive an expert. This habit of many harmless forms has often resulted in their death, they being first mistaken for adult rattlers, though, when killed, the excited hero, not finding the terminal appendage, and not willing to allow the mistake, maintains it is a young rattler, an assumption often apparently substantiated by an inspection of the tail, which is often tipped in many innocuous ophidians by a smooth horny scale.

Crotalus durissus is the introductory species, and is found from Mexico to Brazil. It has often been confused with *C. horridus*, but is at once distinguished from that animal in that it has the scales arranged in twenty-nine or thirty-one rows, and the dorsal markings more regular and taking on a lozen-shaped form. The keels of the scales are very large and swollen, though, as in *C. horridus*, they do not arm the outer row of scales, which are large, smooth, and broad. The general color is yellowish brown, ornamented along the back by a series of sub-diamond-shaped brown spots with light centres and yellow borders, and which, as they continue to the flanks, enclose rhombs of the general ground color. The yellowish belly is clouded with darker shades.

Crotalus molossus is a native of New Mexico and Arizona, and is characterized



Crotalus lucifer, Oregon rattlesnake.

by having the nasal plates divided; four prefrontals; eighteen labials; seventeen infralabials, and the scales in twenty-four rows. The body is yellowish, strongly marked with a dorsal series of rhombs, similar to those of *C. adamanteus*. An allied species collected at Fort Whipple, measuring thirty-one inches in length, contained an adult blue-bird, *Sialia mexicana*. They are reported from the San Francisco mountains at an elevation of 10,000 feet, and inhabit dry rocky ground. *C. confluentus*, the prairie rattle-snake, is very abundant along the Missouri River and its tributaries from Nebraska to the Rocky Mountains. During the hot season they retire to the dry cañons, where they hide among the willows, being extremely sluggish and stupid, and possibly partially blind, as the cuticle, though cleaving from the body and eyes, is not as yet shed. The head is sub-triangular, and the plates irregular, angulated, imbric-

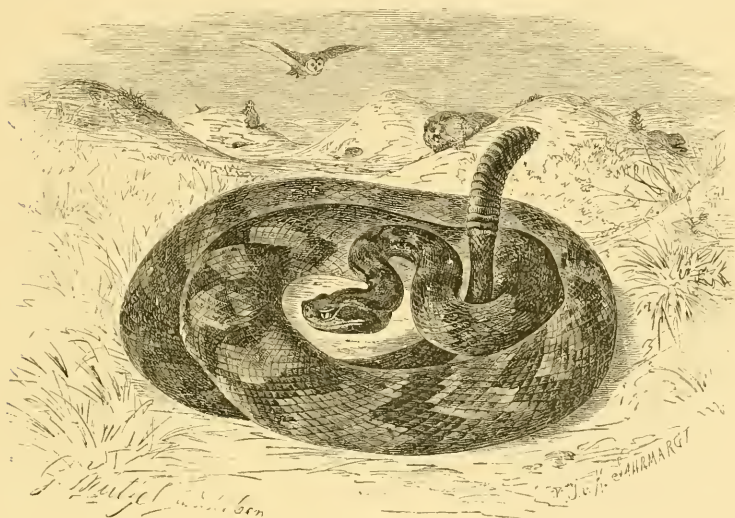


FIG. 230. — *Crotalus durissus*, rattle-snake.

eated, and not infrequently tuberculated. The labials are from fourteen to eighteen above and below, and the scales of the body are arranged in from twenty-five to twenty-nine rows. Along the back there are between forty and fifty brown spots margined with narrow white lines. *C. polystictus*, inhabiting the table-lands of Mexico, seldom reaches the length of two feet. There are two nasals, two loreals, fourteen labials, and thirteen infralabials; and, of the twenty-seven rows of scales, all are keeled excepting the lower two. Along the back is a median yellowish stripe bordered by lines of grayish brown, and ornamented by a series of seven brownish black spots.

C. lucifer, the western black rattle-snake, was brought to the light of science in 1852, by the description of Baird and Girard from specimens captured by members of the exploring party under Captain Chas. Wilkes in California and Oregon. The

general color is reddish brown above, deeper along the back, and yellow beneath, though a specimen that had just shed its skin, captured on the Columbia River, had the ground color pure white, with sea-green patches on the back. Ordinarily, the patches are in a series of sub-circular white rings, lined internally with a narrow black line. The internasals are subdivided, and separated from the nasals by a row of small scales. The rostral plate is small and pointed above, and pentagonal in form, and there are from thirteen to sixteen labials. The scales of the body are arranged in about twenty-five rows. Rattle-snakes are most abundant south of the Columbia River; west of the Cascade Range they are very rare. At the Dalles the present species has been so abundant as to be very annoying, specimens sometimes entering

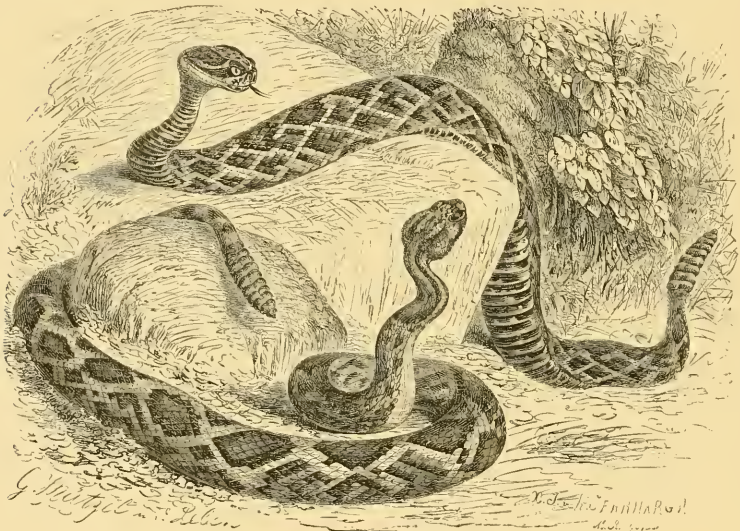


FIG. 231. — *Crotalus adamanteus*, diamond-rattler, and *C. horridus*, banded rattlesnake.

human dwellings, though of late, since the introduction of hogs, their numbers have considerably decreased. The Indians, it is said, use the tail of this rattlesnake to produce abortion.

Crotalus adamanteus is distinguished by having the parietals and frontals scale-like, the nasal divided, the loreals generally two, and the scales, the keels of which are not tubercular, arranged in twenty-seven or twenty-nine rows. The color is yellowish brown, and the back is ornamented by a series of about thirty distinct, diamond-shaped spots, which are dark brown in color, with a lighter centre, and margined with yellow; on the tail these spots pass into transverse bands. This species is an inhabitant of the southern states, and its varieties extend to California and into Mexico. In its habits the diamond-rattler prefers the damp and shady places in the neighborhood of water, though there is no evidence that it follows its prey into that

element. From this preference the reptile is commonly known as the water-rattler in some portions of the south, though the name diamond-rattler, given because of the diamond-shaped markings of the back, is more general. Hollbrook, in speaking of it, says: "A more disgusting or terrific animal cannot be imagined than this; its dusky color, bloated body, and sinister eyes of a sparkling gray and yellow, with the projecting orbital plates, combine to form an expression of sullen ferocity unsurpassed in the brute creation."

The most abundant species east of the Mississippi is *C. horridus*, popularly known as the banded rattle-snake. It has a very general distribution from Maine to Texas, being in some localities quite common, though the universal war waged against the species has greatly reduced its numbers. At one time it was very abundant on a low range of hills in eastern Massachusetts, where it was possible to obtain several specimens in a short time, but it is now extremely rare, and is only met with on the most unusual occasions. Further south, in some localities, the animal is still abundant, though never occurring in such numbers as to, in any way, hinder — as a related form of the west does, — the local sportsman from following his bent. It is naturally sluggish, and will often remain perfectly motionless while an unsuspecting intruder passes within a few feet, but the instant the reptile is perceived, it ordinarily coils itself for an attack, and may remain thus on the defensive, ready to strike at whatever may displease him, but never following the object of his rage; after a short time he may uncoil, and, as Hollbrook says, "slowly retreat like an unconquered enemy, sure of his strength, but not choosing further combat." That the reptile cannot strike unless coiled, is a mistaken notion, for although this position is ordinarily chosen, — the animal thereby having a greater reach, — when angry and confined it will strike right and left, coiled or uncoiled.

The rattler feeds on small rabbits, rats, and squirrels, which latter Dr. Bachman, the intimate friend of Audubon, has observed the snakes to watch as they sported among the branches of a large tree; undoubtedly waiting to pounce on some unfortunate one that might descend for a fallen nut or acorn, or possibly to search for water. The old belief that serpents 'charm' is now obsolete, though not extinct. That such a belief should once have been current is not surprising, since birds are often seen to flutter around a marauding snake, but really more from maternal solicitude and friendly sympathy on the part of the birds than from any reptilian power of fascination. The instinctive, and sometimes paralyzing horror which seizes on one when he knows he is the object of some frightful monster's fixed gaze may also be adduced as a cause for a belief so general until within a few years.

The parietals and frontals are scale-like; the nasal plate divided; scales in twenty-three or twenty-five rows, of which all but the lateral are strongly keeled; the labials are numerous, there being along the upper border of the mouth from twelve to sixteen on each side, and eighteen along the lower jaw. There is a dorsal series of more or less irregular and imperfect transverse bands; the general coloration is variable, some specimens have the ground of a bright yellow color, while others are almost black. The length of four feet is seldom reached, though a specimen fifty-four inches long has been captured. As many as twenty-three rings in good condition have been known to compose the rattle.

Crotalus enyo resembles *C. molossus* in general coloration, and is a very beautiful animal. It can easily be distinguished from the species named, however, as it has a peculiar scutellated muzzle, and there are only twenty-three rows of scales, *molossus*

having twenty-nine. It is of a yellow color above, with the ordinary series of small transverse rhombs, which send lateral prolongations to the sides of the body. It inhabits Lower California.

Crotalus tigris is a form which has the nasal plate divided, and the keeled scales disposed in as many rows as those of *C. cerastes*. The head is depressed, and being narrow behind, and the nose broad and obtuse, it is quite quadrangular in outline. The animal is of a yellowish ash above, with small clustered blotches anteriorly, which develop into brown bands further back. *C. cerastes* inhabits California, Arizona, and

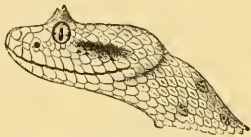


FIG. 232.—Head of *Crotalus cerastes*, horned-rattlesnake.

Mexico, preferring localities where there is absolutely no trace of vegetation, such as are those of the southwest deserts, where it is extremely abundant. Its chief structural peculiarity is the pair of horns surmounting the head, and giving the animal the appearance of the horned-viper, *Vipera cerastes*, of Africa, which animal it further resembles in being very sluggish, and in its choice of locality. The

New Mexicans have named this animal the 'side-winder,' because of the slightly lateral motion which they have in passing forwards.

The next member with which we deal is *C. pyrrhus* which has the head obtuse and rounded, the labials fourteen, and the loreals four. It is a most highly colored animal, being of a bright salmon red, with transverse bars of a deeper shade, which are broadest along the back, and lateral series of yellow blotches. A specimen captured in Arizona during a hasty retreat from hostile Indians, by members of the 'Wheeler Survey,' attracted considerable attention as a 'red rattle-snake.' *C. mitchellii* has many points in common with the red-rattler, though it has but one loreal, and the small upright nasal is separated from the rostral and labials by a series of small scales. The general color is grayish yellow, with indistinct quadrate markings along the back, which at the tail are reduced to bands. The scales are in twenty-five rows. This animal, the last of the genus, has been only found in Lower California.

The last and highest member of the family Crotalidae is the *Aplouspis lepida*, a form inhabiting western Texas, and first described in 1861.

ORDER II.—PYTHONOMORPHA.

The members of the order which we now treat lived at a time when the American continent was considerably lower than it now is. New Jersey and Delaware, as well as a greater portion of the southern states, were then under water. The Mexican Gulf extended as far north as the Ohio River, and the Rocky Mountains, in some places 10,000 feet lower than they now are, appeared as a range separated from the valley of the Mississippi by a broad expanse of salt water which teemed with animal life; the immense chalk-like deposits of the protozoans suggesting the name of the period, the cretaceous. It was during this period, when the sea was somewhat warmer than at present, that gigantic reptiles, in their general form and movements resembling huge eels, ploughed through the water by means of their four paddles and propeller-like tail, in search of fishes and other marine life, much in the same manner as does the sea-snake of to-day.

The Pythonomorphs, though occasionally found in European deposits, are best known from American specimens, which are abundantly found in the limestone rocks of Kansas and the cretaceous deposits of New Jersey and Alabama. A careful examination of the fragments has shown that the animals were greatly elongate; the head large, flat, and conical; the eyes, though placed at the sides of the head, being directed more or less upward; and the limbs represented by two pairs of broad paddles, firmly united with the body. In several particulars these ancient forms resemble the serpents. The teeth were disposed in four rows along the upper jaw, though differently arranged, for although the palatine and maxillary bones were armed, the premaxillary teeth appeared in two rows instead of one. They were used only as organs for seizing the prey, which was swallowed whole, without mastication. The lower jaw had not the bones connecting it with the head movably articulated and allowing displacement, though the rami were united in front by the elastic ligament so characteristic of the previous order. The distention of the mouth was provided for, however, by a special structure only represented in a few serpents and in the young of some birds, like the heron. This consisted in the jaws being provided, midway

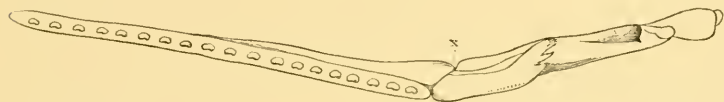


FIG. 233. — Jaw of *Clidastes*; x, splenial articulation.

of their length, with a hinge, the splenial articulation, which enabled the rami to bow out and allow the most bulky prey to gain easy access to the large and spacious gullet.

By reference to the figure of *Clidastes*, it will be seen that the pectoral arch consisted of only a scapula and coracoid, and that the pelvic arch had no rigid sacrum, and was but loosely united on the middle line below. The ilia were long, and not immediately in contact with the vertebral column. The pubic and ischiatic bones were small and free. The pes and manus, and both limbs, were small in proportion to the size of the animal, and of a less robust type than in any other order of marine Reptilia.

The quadrate bones movably attached to the sides of the skull, the simple articulations of the ribs, and the free vertebrae of the sacral region, are points which unite Pythonomorpha with Ophidia and Lacertilia. The general structure of the posterior portion of the lower jaw is like that of lizards, while the chevron bones, protecting the sub-caudal continuation of the aorta, are not ophidian. The teeth, being without true roots, are not like those of Lacertilia, nor are they identical with those of Ophidia. It will be seen that the animals require an intermediate position between the previous order and the one succeeding, the Lacertilia. With the other orders, except the Chelonia, which they resemble in having the quadrate bone partly enclosing the auditory meatus, and a few points resembling the Plesiosaurs, they have little or no affinity.

The genus *Clidastes* is represented by about a dozen species once inhabiting the

coasts of New Jersey and Alabama, as well as the "Western Sea." It contains the most elongate forms of the order, though they do not reach such a size as do some of the *Liodons*. The quadrate bone gives evidence that there was considerable lateral flexure of the mandibular rami; and that the animals were strong and muscular is shown by the striations and sculptures still appearing on many of the bones. That the vertebral column might not be dislocated by the animal's powerful contortions, the vertebræ are provided with an extra pair of articular processes which are very characteristic. The largest representative is *C. cineriarum*, from the Kansas strata, and reaches a length of forty feet. *C. tortor* was a lithe and active animal, with numerous knife-like teeth, and probably fed on fish. *C. pumilus* is remarkable for its small size, being only about twelve feet in length. It was probably not infrequently the unfortunate prey of some of the larger cretaceous sharks.

The genus *Platycarpus* is also represented by about a dozen species which resemble *Clidastes* in the form of the humerus, though the vertebral articulations are like those of *Liodon*. The muzzle is considerably shorter than in the previous genus, from which the animals also differ in having the chevron-bones free from the vertebral centra. The teeth are very characteristic, being neither compressed like *Liodon*, nor angularly faceted as in *Mosasaurus* but are curved and, in section, sub-circular. Such specimens as have been discovered have been of medium size.



FIG. 234. — Skeleton of *Clidastes*, restored.

Mosasaurus has been abundantly found in the greensand of New Jersey, and other cretaceous localities further south. It differed from the two previous genera in having the flippers more pedunculate, the humerus and femur being more slender, and in having the teeth provided with facets. The chevron-bones are in part coössified, and the arches of the vertebral column interlock, presenting in rudiment, the articular processes of *Clidastes*. The representatives of this genus, of which there were in Europe two, and in America, where the animals were much more abundant, nearly a dozen species were, like other Pythonomorphs, long and slender, and with a flattened, pointed head. The food, which was captured alive, was quickly swallowed, passing, on its way to the loose pouch-like gullet, between the expanded branches of the lower jaw. *M. maximus* was the largest species, and sometimes reached a length of eighty feet.

The genus *Liodon* has the teeth compressed, lenticular in sectional outline, and formed for cutting. The vertebræ have not the strong articular processes of *Clidastes* and the humerus is small and narrow. The typical species of the genus was described by Owen from remains found in the English chalk, and is extremely rare. In America the forms abounded during the chalk period and were the giants of the order. *L. proriger*, of the Kansas beds, measured seventy-five feet in length, and was provided with a long projecting muzzle, a development possibly used as a ram when fighting. *L. dyspctor* was probably the largest of known reptiles, considerably exceeding the *Mosasaurus maximus* in size. The source of the food supply of such monsters may well excite our curiosity, as their magnitude does our surprise.

ORDER III. — LACERTILIA.

To this order belong the lizards, which may be defined as all now existing reptiles having a pectoral girdle and sternum, and, as a rule, four limbs. A tympanic cavity is usually present, and the eyes, with a few exceptions only, are provided with lids. The bones of the jaws and head do not allow that expansibility generally characteristic of snakes, and a still further departure is made from this group in that the lizards are provided with a urinary bladder.

The lizards are generally of an elongated form, and snake-like, some carrying the resemblance still further by having the limbs reduced to rudiments, or externally entirely absent. The limbs, when present, are seldom sufficiently strong to support the body from the ground, and are hence used more as pushing organs, though the chameleons have them designed for grasping, the geckos modified into sucking disks, by which they can ascend perpendicular walls, some of the iguanas for swimming, and yet others for digging. It will thus be seen that the animals are designed for different modes of life. While some lizards are terrestrial, and have the limbs poorly developed or even absent, others are arboreal, and, like the arboreal serpents, are specially modified and protectively colored. It is in this order, however, that we first find reptiles designed for an aerial, or partially aerial, life. The shoulder girdle is always present, and the shape of the clavicle is of considerable taxonomic value. The sternum is absent in a single genus, *Amphisbæna*. The ribs are generally present, and extend from the anterior cervical to the lumbar vertebrae. These ribs, in forms like *Draco* and *Liolephis*, are the chief organs of support for the wing-like expansions of the sides of the body.

The structure of the skull is particularly interesting, though complex. On its peculiarities has been based the only natural classification. The cranium proper, that portion of the skull enclosing the brain, is relatively small; it does not extend to the orbital region, and is protected in front by a vertical curtain, the membranous inter-orbital septum. The bones of the jaw are connected with those of the cranium by the intervention of an arch, the zygomatic, made up of the malar, postorbital, and squamosal bones. The quadrate is large and much more firmly attached than in either of the previous orders. The rigidity with which the bones are united is worthy of notice, and particularly interesting when compared with the loosely articulated facial bones of the serpents. The lower jaw is incapable of lateral expansion, either by means of an elastic symphysis, or by a medial joint.

The dentition is peculiar, and, to a certain extent, characteristic. Much more variety as regards general structure, mode of insertion, and position of teeth, is presented than in the previous orders, though these peculiarities are of only secondary value in classification. In many families there is an interesting distinction between Old and New World forms; the former having the teeth planted along the ridge of the jaw are termed *aerodont*, while the latter have them merely appressed to the inside, and are *plurodont*. A peculiar anomaly is presented by the American genus, *Telus*, the teeth in the young being plurodont, and, as age proceeds, by a growth of the bone of the jaw around their bases gradually becoming aerodont.

Though the shape of the tongue is very variable, and, to a certain extent, characteristic, its covering is of far more importance to the systematic zoologist. Though the lower families and the degraded *Amphisbænas* have the eyes, like the serpents,

unprotected by lids; the higher forms have well developed lids; some, like the skinks, having the lower so transparent that it performs the office of a nictitating membrane, though closely related forms may have it opaque and scaly. The keen-sighted chameleons have the eye entirely surrounded by the lid, vision being obtained through a central slit.

The integument of lizards, though often provided with scales, is not invariably so protected; the geckos and *Amphisbænas* offering the most familiar exceptions. The scales, when present, present considerable variety of structure, which is of use in determining the several genera and species. These scales are often of considerable size, especially when connected with the cutaneous expansions of the throat, back, and sides. Along the inside of the thigh and across the abdomen the skin is not infrequently pierced by ducts leading from subcuticular glands. These openings are called pores.

Though the majority of lizards are oviparous, a few, like *Anguis*, *Seps*, and *Phrynosoma*, give birth to their young. With the exception of *Heloderma*, all are perfectly harmless so far as poison is concerned, and are generally of a most timid nature. They are by far the most numerous, and present the greatest variety of coloration in the typical countries.

The classification herein adopted is the most natural, and is based on a thorough study of the anatomical peculiarities of the order, a result of the labors of Professor E. D. Cope and G. A. Boulenger. Twenty-one families are characterized, all of which are treated to a more or less extent.

The first family, GECKONIDÆ, is easily recognized. It includes a number of the lower developed lizards, which have the centra of the vertebrae concave both anteriorly and posteriorly. They are further characterized by having the tongue short, thick, and fleshy, the eyelids rudimentary, and the pupils of the large eyes generally vertical and elliptical, a peculiarity which points to a nocturnal life. They are all pluridont, and the head is broad and depressed; the body is of moderate breadth, granular above, and covered below with small imbricate scales; the tail is normally thick at the base, and tapering, though it is so often broken off that it is generally somewhat deformed. The limbs are stout, of moderate length, and the well-developed toes are usually provided with an adhesive apparatus, made up of a series of plates or disks, by means of which the animals can run up a perpendicular wall or smooth tree. Though nearly all are provided with claws, the sucking-disks are less perfectly developed in the arboreal forms. The acrid fluid secreted by the disks has given the erroneous idea that the animals are poisonous.

There has been observed in many geckos a peculiar pair of calcareous masses on each side of the neck. These seem to vary in size with different individuals, in some being entirely absent, while in others of the same species they may appear either as a thin layer or as hard rounded masses. No dermal pore has been discovered to connect them with the exterior.

The geckos are small in size, never exceeding fourteen inches in length, and are carnivorous; destroying the larger insects and moths, and are to some extent cannibalistic, eating their own young, and, what seems most surprising, they have been observed to devour their own tail, an organ which they seem to regard as purely ornamental, to be dispensed with whenever the occasion demands. Among themselves they are quarrelsome, and often fight over their prey. They are noisy at night, many being named, as is the gecko, from the peculiarity of their calls.

Platydictylus mauritanicus is found in the countries bordering the Mediterranean and is known in the south of France as the *tarente*. It is never found in damp or shaded localities, but delights in the sunshine, being found about ruins and old walls. The colder portions of the year it spends in an inert condition, hid away in some crevice, or under the tile of an old house, ready to creep out on the first warm days of spring. It is a perfectly harmless animal. Of its cry nothing is known.

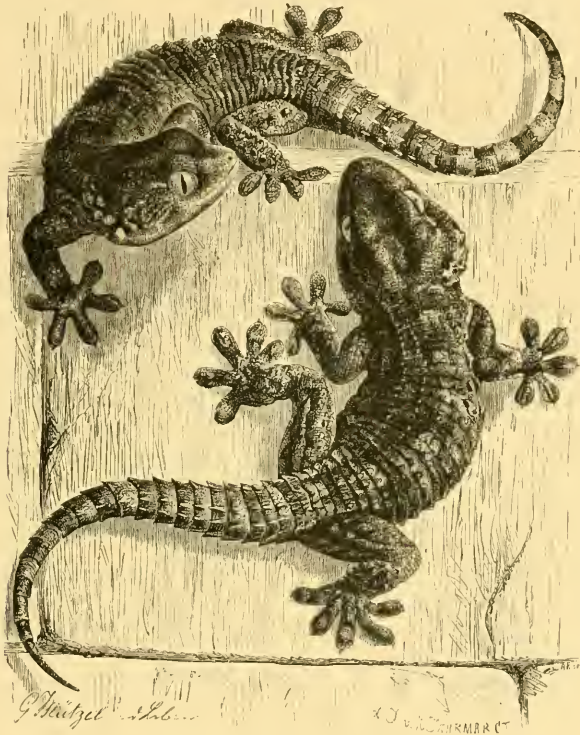


FIG. 235. — *Platydictylus mauritanicus*, tarente.

Sphaerodactylus notatus, one of the smallest American lizards, measuring about two inches in length, is the only gecko in the United States, though there are three or four in Mexico and Lower California. Each of the toes is terminated by a small rounded disk, by means of which, the animal can wander over the perpendicular faces of rocks. The reptile is very rare in collections, though it has been several times taken in Florida and Cuba. While the scales on the back and sides are large and keeled, those of the belly are smooth, small, and hexagonal.

The genus *Hemidactylus* is very generally distributed through the warmer regions of the globe, and is characterized by having the dilated toes armed beneath by two series of transverse imbricate plates, and the trunk and tail without lateral cutaneous appendages. *H. trihedrus* has the back granulated with numerous trihedral tubercles, some of which equal the opening of the ear in size. The femoral pores do not cross the pre-anal region. This animal, which reaches a length of seven inches, inhabits the coast of Malabar, avoiding the habitations of man, only living in rocks and trees. Of much different habits is the semi-domesticated *H. maculatus*, the most common gecko in India, and extending its geographical range into China, the Philippine Islands, and



FIG. 236. — *Hemidactylus verruculatus*, gecko.

Mauritius. *H. fronsatus*, the cheecha of Ceylon, inhabiting also India and possibly south Africa and Polynesia, is a most interesting little animal. But four or five inches in length, it makes its appearance soon after sunset, about the walls of the Indian dwellings, in search of flies or other small insects. If some attention be shown it, however, it will present itself every evening at the accustomed place, where it expects rice or morsels of bread, soon becoming very tame. The female lays three or four eggs in a crevice of some old wall, or possibly in a hollow tree. *H. verruculatus* inhabits the shores of the Mediterranean, where it is often found in cellars. It is of a reddish-gray color, with back and tail covered with conical tubercles.

To the collector in the island of Jamaica, the croaking-lizard, *Thecadactylus*

levis, is a most abundant, as well as a most interesting, animal, though of repulsive appearance and unfounded bad reputation. It is found everywhere; in the out-buildings, old mills, and cattle-sheds, making its presence known by a singular croaking noise, which it maintains throughout the night, resembling that produced by drawing a stick over the teeth of a comb. The eye is unprotected by lids, and though the pupil is large and circular during the night, in the day time it contracts to a small vertical slit, giving the animal anything but a prepossessing expression, a marked contrast to the meek countenance of the there abundant *Ameivas*. The skin of the croaking gecko is very soft and fragile, tearing, like wet paper, almost on the slightest touch. The conical tubercles of the head and back are more depressed posteriorly, where they are flat and scale-like. The tail is very fragile, though on being lost it is soon and rapidly replaced. One in captivity had a new appendage grow to the length of an inch and a half in less than three months. The female has a special place, some crevice in a tree, to which she repairs every little while and deposits an egg, sometimes these are found to the number of eight or nine, firmly glued together, and containing embryos in different stages of development.

The flying-gecko, *Ptychozoon homalocephalum*, is well worthy of notice, being among the lizards what the flying-squirrel is among the rodents. The toes are well spread apart, armed below with a single series of undivided transverse plates, and all but the thumbs are terminated by claws. The most wonderful developments, however, are the wing-like expansions of the skin, which appear as horizontal plates, extending from the sides of the head, body, and tail, and continued as flaps on each side of the limbs, and as webs between the toes. These dermal expansions are only used when the animal is leaping; they then act as a parachute, in the same way as the so-called wings of the flying-dragon. When at rest, a series of muscles draw them close to the body, so that they offer no hindrance to the animal's movements.

The flying-geckos are very beautiful and interesting. Cantor observed a pair which he kept for some time in confinement. The power of changing the shade of the body was possessed only to a limited degree. The female, after neglecting for some time an egg which she had laid, finally disposed of it by using it as food. The male was also equally economical, always devouring his exuviated skin.

The Xantus gecko, *Phyllodactylus xanti*, was described in 1863 by Professor Cope from a specimen obtained at Cape St. Lucas by the person to whom it was dedicated. Since that time several more have been captured in the same locality. They are about nine inches in length, and ornamented with fine blackish cross-bars, which continue on the tail as rings. *Diplodactylus unctus* is also a native of Lower California, where it is called the St. Lucas gecko. It differs from *P. xanti*, which it about equals in size, in several structural peculiarities, though both genera are alike in having the toes provided along the under side with two rows of membranous plates.

The family EUBLEPHARIDÆ includes a small number of gecko-like lizards, which differ from the members of the previous family, however, in having the vertebrae pro-cælian, *i. e.*, with the centra concave anteriorly, and in a few other skeletal peculiarities. Three genera are included, one from each of the three continents, Asia, Africa, and America.

Eublepharis hardwickii is a rare form inhabiting India, where it ordinarily passes for a gecko, though on examination it is evidently of entirely different habits. Its toes, not being compressed or dilated, prevent it from climbing any plane of more than ordinary inclination, while the short, stout claws, show it to be a terrestrial

animal, which habit is also indicated by its ordinary scaly toes. The body, as well as the head and limbs, are covered with tubercles of varying size, while the lower parts are protected by small imbricate scales. The tail is thick and cylindrical, and covered with rings of small sub-quadrangular scales, which on its dorsum appear as flat tubercles.

The American genus *Coleonyx* is represented in Texas, California, and the Colorado desert by a rare animal, *C. variegatus*, or the variegated gecko. In coloring, it is, above, of a brownish yellow, ornamented with irregular blotches of reddish brown, which sometimes are arranged as transverse bands. Along the edges of the eye-lid, as well as the entire under surface, a pure white color obtains. The toes bear claws. *Psilodactylus* is an allied form inhabiting West Africa.

The family UROPLATIDÆ is the first of a large number of families which resemble each other in having the tongue either smooth or covered with villose papillæ, never

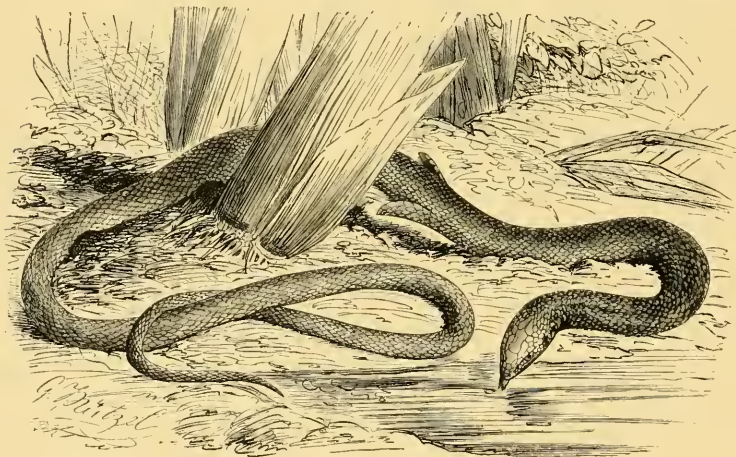


FIG. 237. — *Pygopus lepidopus*.

with scale-like papillæ, and in having the proximal portion of the clavicle dilated. It has the vertebrae concave on both faces, and several peculiarities in the arrangement of the bones of the head. But a single genus, *Uroplatus*, is known, of which *U. fimbriatus*, the famocantrata, inhabits Madagascar, and was first mentioned in an early history of that island in 1658. It is a peculiar animal with webbed toes, and with a series of fringes passing down the sides of the head, body, and tail, which latter is described as being much shorter than the body, and oar shaped. The natives, from the animal's habit of running at them with open mouth, particularly dislike this harmless form, even considering it to be of a poisonous nature, and pretending that, by its membranes, it so adheres to the breast, the portion of the body which they claim it always attacks, that a razor is necessary to free it from the skin.

The family PYGOPODIDÆ is represented by the genus *Pygopus*, which is found in Australia, and has the body cylindrical and elongate, the eyelid rudimentary, im-

movable and scaly, and only a single pair of limbs, the posterior, which are scaly and undivided. *P. lepidopus* has the scales of the back keeled, and the pre-anal pores numerous. In its general structure and habits it resembles *Pseudopus*. *Delma* is an allied genus, having smooth scales, no pre-anal pores, and shorter rudiments of hind limbs, while *Aprasia*, of the same habitat, western Australia, has no indication of limbs whatever.

We now come to one of the more interesting families, the AGAMIDÆ, which is represented in the eastern hemisphere by several aerodont genera.

Agama proper has the body covered with keeled scales, the head triangular, the tail round and covered with imbricate scales, the femoral pores absent, and the pre-anals in a row across the abdomen. *A. catantrops* inhabits the warmer portions of Africa, being particularly partial to dry and arid localities, where it is very watchful and suspicious. If it cannot intimidate the object of its disturbance by its gesticulations, it quickly retreats and conceals itself.

The genus *Calotes* inhabits India and Ceylon, and includes several species which resemble each other in having the tympanum naked; the scales of the back and sides equal, regularly arranged, and their tips directed slightly upward; the dorsal crest formed of non-united spines; the gular sac but slightly developed; the sub-caudal scales as broad as long, and the femoral pores absent. The representatives are all arboreal, feeding on insects, tender leaves, and berries. *C. versicolor*, the so-called 'blood-sucker,' is one of the most common animals of the whole continent, extending north into the cooler zones of the Himalahs. The vernacular name was perhaps given because of the occasional reddish hue of its throat. The female deposits her eggs, sometimes to the number of sixteen, in the hollows of trees, or in holes which she digs in the earth; the young appearing after a lapse of eight or nine weeks. During and after showers these animals often descend to the ground, to search for the numerous larvæ and small insects which are washed from the trees.

The genus *Draco* is characterized by a most remarkable growth along the sides of the body, the skin being horizontally spread out as a parachute and supported by five or six false posterior ribs. A pendant appendage like that of the iguana is also present.

The members of this genus, the flying-dragons, are confined to the East Indies, where they lead an arboreal life, lightly shooting from tree to tree by means of their expanded parachutes, or, with these folded to the side of the body, running along like ordinary members of the order, and resembling in their general habits the *Anoles* of the New World. The several species are extremely similar, the distinctions being chiefly based on the relative length of limbs, the position of the nostrils, and the general scutellation. The tail is undoubtedly of considerable assistance in directing their course through the air; to this end it is long and slender, and more firmly articulated than that of less aerial relatives. Cantor, in speaking of the flying-dragons, says: "The transcendent beauty of their colors baffles description. As the lizard lies in the shade, along the trunk of a tree, the colors at a distance appear like a mixture of brown and gray, and renders it scarcely distinguishable from the bark. Thus it remains with no signs of life except the restless eyes, watching passing insects, which, suddenly expanding its wings, it seizes with a sometimes considerable, unerring leap. The lizard itself appears to possess no power of changing its colors."

The several species, of which there are fourteen, are between seven and eight inches in length. Three or four whitish eggs are occasionally found in the females.

D. volans inhabits Java, Sumatra, Borneo, and has been taken at Singapore and Penang.

The frilled-lizard, *Chlamydosaurus kingii*, is an animal of considerable size, nearly reaching the length of three feet, and inhabiting Australia. It is provided, when adult, with an enormous frill or collar attached on each side of the neck behind the ears, which ordinarily lies upon the sides of the body, though, when the animal is excited, the structure is quickly elevated and brought forward, like an inverted umbrella, and being beset on both sides with large keeled scales, is of considerable value as a shield of defence.



FIG. 238.—*Chlamydosaurus kingii*, frilled lizard.

Captain Grey, in writing of this animal, says: "As we were pursuing our walk in the afternoon, we fell in with a specimen of the remarkable frilled-lizard. It lives principally in trees, though it can run very swiftly along the ground. When not provoked or disturbed it moves quietly about, with its frill lying back in plaits upon the body; but it is very irascible, and, directly it is frightened, it elevates the frill or ruff, and makes for a tree, where, if overtaken, it throws itself on its stern, raising its head and chest as high as it can upon the fore legs, then, doubling its head underneath the body, and displaying a very formidable set of teeth from the cavity of its large frill, it boldly faces an opponent, biting furiously at whatever is presented to it, and even venturing so far in its rage as to fairly make a charge at its enemy."

The genus *Histiurus* has the compressed back and tail armed with a crest; that of the tail being much the larger. A representative is the sail-lizard, *H. anboinensis*, so called from the enormous perpendicular development surmounting its tail. It is one of the largest tree-lizards, being nearly four feet in length, and is of a general brown color, shading into green on the neck and head. The animal is chiefly known through the writings of Valentyn, the early Dutch traveler and divine, who found it in the island of Amboyna, where it lived in the woods and thickets bordering streams. The diet, besides seeds and berries, is made up of water-plants, worms, millepedes, and such like. When it is frightened it seeks safety by diving and hiding under some submerged rock, from which retreat, being exceedingly stupid, it will allow itself to be taken in

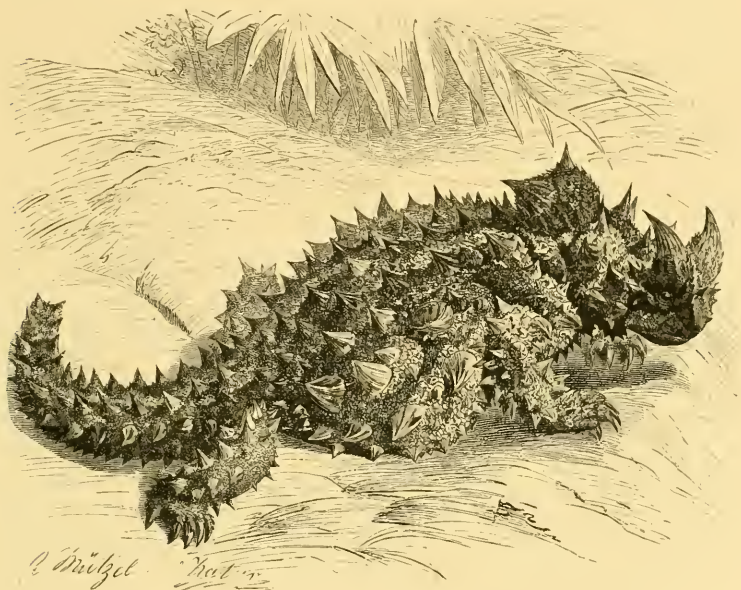


FIG. 239. — *Motoch horridus*.

a net, or may even be grasped by the hand, not offering the slightest opposition to its capture. The natives destroy large numbers of them for food, the flesh being white, tender, and very palatable.

The genus *Phrynocephalus* is restricted to central Asia, and may be recognized by the stout head and anteriorly directed nostrils. The tongue is not notched, but slightly pointed; the eyes small, with well-developed lids, of which the upper is rudimentary and hidden below the projecting superciliary ridge. The body is much depressed and covered above with minute scales, which along the sides become granular; the legs are well developed and are without pores. The tail is said to be prehensile, though this is doubtful.

The Australian moloch, *Moloch horridus*, is one of the most repulsive creatures of nature. While many of our lizards are protected by thorny scales, and some of the *Phrynosomas* have the head armed with horns, the moloch actually bristles with strong, conical spikes, those surmounting the crown and those over the eyes being particularly long and stout. On the back of the neck is a large rounded protuberance covered with spines and having the appearance of a second head. The larger spines of the back and sides are simply conical growths of skin capped by a thin horny covering, and supported by surrounding dermal outgrowths of a similar nature, though of smaller size.

Liolephis, a native of the Malay Peninsula and China, is represented by but a single species, *L. sulcatus*, which reaches a length of about twenty inches. The genus is characterized by having the tympanum naked; the scales small and without keels, the femoral pores present, and by having, and chiefly, the skin of the sides of the body capable of expansion into wing-like organs, which are supported by very long anterior spurious ribs. When the animal is in a state of repose, or is simply wandering among the branches, these organs are appressed to the sides of the body and appear as mere longitudinal dermal folds. But when wishing to pass to some remote position, or if merely agitated by sudden fear or anger, the six anterior ribs, which are greatly elongated, are brought forward, expanding the membranous skin, to which the fore and hind limbs are juxtaposed, and the thus greatly expanded reptile sails off to a neighboring tree, as gracefully as the flying-squirrel. These lizards are naturally very active, and will defend themselves with tooth and nail on being captured. In confinement, however, they soon become tame, and feed on rice and soft fruits.

The genus *Stellio* has the tympanum naked and the body depressed; the scales are spiny on the tail and unequal in size. No pores are present. *S. tuberculatus* inhabits India, and is dusky brown above, speckled with black, and below whitish passing into green on the throat. They have been found on the mountains of Thibet as high as 15,000 feet. Specimens over a foot in length are rare. *S. vulgaris*, called 'hardim' by the Arabs, is found in those countries bordering on the eastern Mediterranean, and is particularly abundant about the ruins of ancient buildings, where, during the warmer portions of the day, they may be counted by the hundreds. They are always busy, scrambling over the hot surfaces of the stones after flies and ants, only stopping to nod their heads,—a habit, by the way, which has resulted in the death of many an innocent, the Mohammedans supposing that the reptiles are mocking in derision their form of worship. The hardims are of an olive-green color shaded with black, and below a pale yellow.

The members of the family IGUANIDÆ are plurodont lizards confined to the warmer portions of the New World. The body, in the more typical forms, is laterally compressed and supported by limbs which are designed for an arboreal life, though forms like *Phrynosoma* may be depressed and terrestrial, while others of different habits may have the body adapted to an aquatic life.

The genus *Polychrus* has the quadrangular head covered with numerous appressed shields; the back without a crest; the skin of the gullet compressed into a small dewlap, and the body covered with smooth scales, which allow the changes in coloration below to be easily studied. *P. marmoratus*, the marbled *Polychrus*, inhabits Brazil and Central America.

The genus *Iguana*, the one most typical of the family, has the head pyramidal,



Iguana tuberculata, iguana.

and often raised along the crown like a helmet; the tongue thick, and but slightly notched, and the dorsal crest well developed. The tuberculated lizard, *I. tuberculata* of the West Indies and South America, is the most familiar type both in illustrations and as museum and menagerie specimens. To those unfamiliar with the animal, it presents an uncouth and most repulsive appearance. Its compressed body, high dorsal ridge, and enormous dewlap give to it more the appearance of some taxidermist's fancy than an animal naturally designed and modified. Though in confinement slow and inactive, it soon learns to know its keeper, to whom it shows a decided preference. In their native haunts, during the warmer portions of the day, they climb some low tree and stretch themselves in the sun, their tail hanging down like that of a snake. When thus basking they are not easily aroused, and, perhaps trusting too much to their protective color, can be closely approached without evincing any alarm. The natives take advantage of this indifference, and while the animal thus lies gently eyeing the intruder, a noose attached to a long stick is slipped over its head, and the unsuspecting animal immediately finds itself jerked from its elevated position to fall a victim to the omnivorous appetite of man. Being an exclusive vegetarian, feeding on flowers, fruits, and fungi, and especially on the leaves of the mangrove, its flesh is palatable, and is white, tender, and nutritious. The pious Père Labat gave, two centuries ago, a very interesting account of the manner in which he saw them captured. "We were attended by a negro who carried a long rod, at one end of which was a piece of whip-cord with a running knot. After beating about the bushes for some time the negro discovered our game basking in the sun on the dry limb of a tree. Hereupon he began whistling with all his might, to which the guana was wonderfully attentive, stretching out his neck and turning his head as if to enjoy it more fully. The negro now approached, still whistling, and advanced this rod gently, began tickling with the end of it the sides and throat of the guana, who seemed mightily pleased with the operation, for he turned on his back and stretched himself out like a cat before the fire and at length fell asleep, which the negro perceiving, dexterously slipped a noose over his head, and with a jerk brought him to the ground. And good sport it afforded, to see the creature swell like a turkey-cock to find himself entrapped. We caught more in the same way, and kept one alive seven or eight days; but it grieved me to the heart to find that he thereby lost much delicious fat." Not only are the iguanas captured in this way, but they are often chased to their burrows or treed by dogs trained for the purpose. They are ordinarily captured alive, and carried to market by people who thus earn a living at certain seasons of the year. The tuberculated lizard does not often exceed the length of five feet.

The naked-necked iguana, *I. delicatissima*, also inhabits the more tropical portions of America, and is, too, an important animal for food. In general form and habits it resembles its more abundant relative, though the neck has no large tubercles, and the cuticular appendage of the chin is small and with only few denticulations. The horned-iguana of San Domingo, *I. cornuta*, is characterized by having a conical osseous point between the eyes, and two raised scales on the nostrils. Though, like the previous species, the scales along the jaws are well developed, there are no tubercles on the neck nor broad plate below the ears. The teeth of this and other related iguanas are very peculiar and characteristic. Not only are they placed along the inside of each jaw, merely attached instead of inserted into alveoli, so that the reserve of incipient teeth have little difficulty in supplying the place of those broken off, but the crowns of the teeth are laterally compressed, and the edges denticulate, bearing

in outline a shape not unlike that of a rounded elm leaf. This structure is very characteristic and has been of considerable value to geologists, as, on finding teeth of a similar nature in several of the Dinosaurs, they are upheld in inferring that these extinct forms had many points in common with the more recent.

Mr. Darwin gives a most interesting account of the lizards of the genus *Amblyrhynchus*. These animals are restricted to, and characteristic of, the Galapagos Islands, a small archipelago lying on the equator, five or six hundred miles west from the Pacific coast of South America. The generic name has been given to these peculiar reptiles because of their abbreviated snout, the head being formed like that of some of the sea-turtles, and though the two species are both vegetable feeders, and



FIG. 240. — *Amblyrhynchus cristatus*, Galapagos lizard.

are acknowledged to be of the same genus, they are of the most opposite habits, one being purely marine, never retreating but a few feet from the shore, and feeding exclusively on seaweeds, while the other is terrestrial, feeding on cacti and acacia leaves.

A. cristatus, the marine representative, is very abundant on all the islands of the group, in some situations so congregating as they lie basking in the sun as to almost line the rocks along the shore. Though allied to the iguana, the tail is laterally compressed and serves as the chief organ of locomotion, as the animal by horizontal flexions of its body, propels itself through the water; the limbs, with the partially webbed toes, being appressed to the sides and only used to give an occasional push as the animal glides along near the rocky bottom in search of the soft green

foliaceous seaweeds (*Ulva*), plants which are also abundantly found on our shores. Though so pre-eminently an aquatic animal, having been known to live for an hour below the surface, it is a strange fact that on the apprehension of danger, whether from land or sea, it invariably takes to the shore. This anomalous habit may be explained by the fact that its original and only enemy may have been some predaceous shark, to escape which its only safety was in flying to the shore, which by an hereditary instinct became to it the only place of refuge. Mr. Darwin says: "It is easy to drive these lizards down to any little point overhanging the sea, where they will sooner allow a person to catch hold of their tails than jump into the water. They do not seem to have any notion of biting, but when much frightened they squirt a drop of fluid from each nostril. I threw one several times as far as I could into a deep pool left by the retiring tide, but it invariably returned in a direct line to the spot where I stood. It swam near the bottom with a very graceful and rapid movement, and occasionally aided itself over the uneven ground by its feet. As soon as it arrived near the edge, but still being under water, it tried to conceal itself in the tufts of seaweed, or it entered some crevice. As soon as it thought the danger past, it crawled out on the dry rocks and shuffled away as quickly as it could. I several times caught this same lizard by driving it down to a point; and though possessed of such perfect powers of diving and swimming, nothing could induce it to enter the water, and, as often as I threw it in, it returned in the manner above described." The animal is of a dirty black color and of about a yard in length. Of its breeding habits nothing is known.

A. demarillii, the terrestrial species, differs from the previous in having the tail cylindrical, and the toes without webs. The individuals of this species, though not found in all the islands of the archipelago, are on some so abundant that it is with considerable difficulty that a plat of ground, free from their burrows, large enough to pitch a tent on, can be found. These burrows being dug at but a small angle with the surface of the ground, are so poorly roofed over as to make traveling very difficult and tiresome, the soil constantly giving way. The animals, which are somewhat smaller than those of the previous species, are lazy, half torpid, and in their motions semi-mechanical. When running along the surface of the parched soil they often stop and doze, their eyes closed, and their hind legs awkwardly spread out. They are diurnal, and seldom wander from their burrows, to which they immediately retreat on being disturbed, and with a most awkward gait. They are not timorous, however, often elevating themselves and watching one with the drollest expression. After considerable irritation they can be made to bite, though they are otherwise perfectly harmless. Those that inhabit the more arid portions of the islands, are compelled to go for long periods without tasting water, though they consume great quantities of the succulent cactus, to which plant they are very partial, as are most of the animals of the locality. The birds seem to be well aware of the mild disposition of these animals, as they not infrequently eat of the same fragment, and have been even known to perch upon the reptile's back. These lizards, as well as their eggs, which are laid in their burrows, are used as food by those—as Darwin characterizes them—"whose stomachs soar above all prejudices."

Members of the genus *Metapoceros* are found on the islands of Navaza and Haiti, where they are large and strong. The older specimens are peculiar in having, under the basal joints of the third and fourth toes and the second joint of the third toe, a number of scale-like scrapers.

The genus *Cyclura* was distinguished as early as 1825, when it was applied to those lizards which have a general resemblance to the iguanas; three species are now known to inhabit the peninsula of Lower California. *C. teres*, the smooth-backed *Cyclura*, has a length of about twenty inches, and is of a general dark-green color. Like others of the genus it has a loose fold of skin below its throat, a structure that is maintained by some to be indicative of an irritable disposition. The comb-like spines appear as a low ridge running from the occiput to the sacral region, where after a short interspace, the more prickly caudal crest begins, sending out laterally about two dozen spiniferous branches, which extend as rings completely around the tail, though the spines decrease in size as they leave the dorsal line. On the inside of

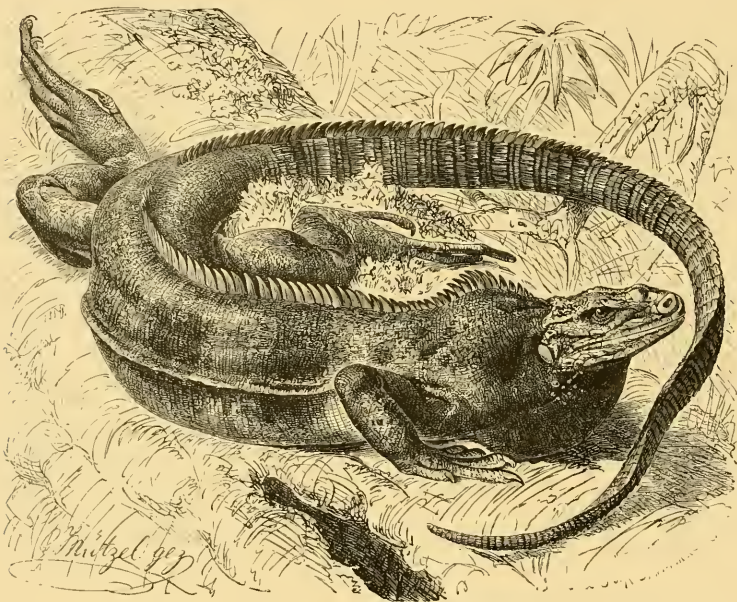


FIG. 241. — *Cyclura lophoma*, great iguana.

each thigh is a row of seven glandular orifices. *C. hemilopha* has the scales of the dorsal crest along the nape considerably elongated, though they soon diminish in size, entirely disappearing at about the middle of the back. *C. acanthura* is the spine-tailed lizard described by Shaw in 1802. It is a rare animal, inhabiting Lower California. *C. lophoma* is the great 'iguana' of eastern Jamaica, and is provided with an elongated dorsal crest like the teeth of a saw. Like the lizards of the related genus *Iguana*, this animal spends most of its time, during the warmer portions of the day, lying out on the sunny branches of some tree.

The range of *Basiliscus* extends northward into southern Mexico. In novelty of appearance this animal rivals the Australian *Chlamydosaurus*. The basilisk proper

is one of those animals mixed up in the superstitious traditions of the ancients, and still regarded by some with the greatest awe, being to them the king of the reptile race, bearing a crown as a symbol of his sovereign rule. It was thought that he had no regular occupation, and that he feasted on an egg laid by a cock and incubated by a snake, though that the egg was thus incubated was denied by some 'naturalists,' who maintained that a toad performed that arduous task. From the glance of this



FIG. 242. — *Basiliscus mitratus*, basilisk.

mighty reptile's eye, death and destruction spread. "This poison," writes an author, "infecteth the air, and the air so infected killeth all living things, and likewise all green things, fruits and plants of the earth; it burneth up the grass whereupon it goeth or creepeth, and the fowls of the air fall down dead when they come near his den or lodging. Sometimes he biteth a man or beast, and by that wound the blood turneth into choler, and so the whole body becometh yellow or gold, presently killing all that touch it or come near it." The cock was the only animal before whom this

terrible reptile would cower, and that the travelers of the deserts might be protected, they often carried with them a supply of these loud-voiced chanticleers.

Such are the traditions connected with the name of a harmless, inoffensive animal, seldom exceeding the length of three feet, and inhabiting the forests of Guiana and Martinique. It differs from the other members of the family in not possessing the long extensible skin of the throat, and in being provided with an elevated unsegmented crest along its back, and a second along the dorsal side of the tail, which is strengthened by the elongated spinous processes of the vertebral column. Though it might be inferred from the compressed tail that the animal is aquatic, such is not the case, as it lives an arboreal life, preferring the low branches of trees in the neighborhood of some quiet brook. Upon the occiput is a most singular hood-shaped crown, which is said to be capable of considerable distention.



FIG. 243. — *Anolis principalis*, American chameleon.

The widely distributed genus *Anolis* is represented in the United States by two species, of which *A. principalis*, inhabiting the southern states, is by far the most abundant, and is known as the American chameleon, or scorpion. The figure of this animal is considerably enlarged, as its body seldom exceeds the length of three inches and a half, though the elongated tail may be half a foot in length. The entire animal is covered by minute scales, those of the jaws and head being somewhat larger, and regularly arranged. The gape of the month is capacious, and the ear opens just back of its commissure. The dewlap extends from the chin to the sternum, and by a special arrangement can be vertically expanded like a fan, when it is of a deep red shade, or may be retracted so as to be scarcely visible. Though the general color of the animal below is white, above it may assume almost instantly shades varying from a beautiful emerald to a dark and iridescent bronze color.

The chameleons are particularly abundant about cemeteries, finding a ready means of retreat in the chinks of the old oven-like tombs of the south. They are not confined to these situations, however, but abound everywhere; on fences, plank-walks, wharves, dry weeds, and brushwood. When on the broad green leaves of the palmetto, when searched for from above, they are with considerable difficulty perceived, so exactly is the color of the leaf counterfeited; though, on looking on the lower side of the leaf, their dark shadow is very distinct. Few animals exhibit mimicry of color to a greater extent than does this. Not only is the color constantly changing and passing from light to shade, but a passing cloud may cause the customary bright emerald to fade. When surprised, the 'chameleon' eyes the intruder, remaining perfectly motionless until some action frightens him, when, with a dart, he is out of sight, all but his caudal appendage, a bit of vanity which is seized upon by the collector, and as it is better articulated than that of lizards' tails generally, its owner, though involuntarily, falls a victim to "the bottle." But not always does he value his tail more than life; after a short struggle he often frees himself, leaving a bit of it behind, and scampering around bob-tailed until the lost part is renewed. The *Anolis* has many enemies to contend with, of which the most common and most uncompromising is the cat. It is said that this animal will leave anything—meat, birds, and even fish—at the slightest chance of securing one of these lizards.

From an economic standpoint the *Anolis* is a most important agent in restricting the inordinate multiplication of insects, of which it devours great numbers. Though retiring early and sleeping late, they are abroad and at work during the warmer portions of the day, when their prey is most abundant, and when other insectivorous animals seek the quiet of retirement.

Two species of *Anolis*, *iodiurus*, and *opalinus*, are very abundant in Jamaica, where they entertain the visitor by their gambols and scrimmages. Indoors they are very abundant, scrambling over the furniture and walls in search of insects, being particularly destructive to the ants, and not infrequently do they jump on one's clothing without evincing the slightest fear, all the time changing their hue from shades of golden green to dark bronze brown.

The genus *Sceloporus* includes a large number of American lizards which have the head covered with small shields; the back and tail with large keeled scales; the belly with smooth scales, and the femoral pores large. The members have until lately been included under the name *Tropidolepis*.

Sceloporus consubrinus is very generally distributed over the west, and extends north to the Yellowstone. In Arizona it is not only abundant with other lizards in the desert portions of the south, but is also a common inhabitant of the high, dry plains of the mountains. *S. graciosus* is a second widely distributed species. It has the scales of the back larger than those of other portions of the body. It inhabits the sandy situations along the Colorado River, and other similar localities in the west. The different individuals present considerable variation in color, due to the surroundings of the frequented situations. *S. spinosus*, an inhabitant of Texas and Mexico, reaches nearly a foot in length. Its rough carinate scales would give it a most repulsive appearance were it not that the reptile is beautifully maculated with purplish black blotches. The ear opening is armed by three projecting spines, and the body has about a dozen dark spots each side of the dorsal line.

Of about a score of species of the genus found north of Central America, but a single representative, *S. undulatus*, crosses the Mississippi. This species extends

northward to the Ohio River, and even into New York. It prefers the more sandy localities covered with pine, and is often called the 'pine-lizard.' It is a most active animal, quickly scurrying away on being disturbed, and with such celerity that the little reptile is in some localities called the 'swift.' Though elsewhere known as the 'alligator,' and 'brown-scorpion,' it is a most gentle and harmless animal, in confinement having many odd traits. When irritated it elevates its spinous scales, rapidly changes its color, and looks withal a most formidable antagonist. In its free state it may be often seen basking in the sun, on some old fence, or perhaps among the lofty branches of some tall pine, being so rapid in its movements that it can be captured only under the most—to the collector—favorable circumstances. In its coloring it is a beautiful animal. The dark chestnut back is banded with half a dozen undulating black stripes, having along their posterior borders a pair of light-gray blotches, those of a side often becoming contiguous. The silvery abdomen is ornamented on each side by a broad and elongated patch of a blue or green color, bordered with black. The tail, which considerably exceeds the body in length, is slender, and of a dusky color, banded transversely with black.

The genus *Uta* is of particular interest to American herpetologists, from the fact that it combines some of the characters of *Sceloporus*, as the similar shielding of the head, and in being provided with auditory apertures, with the general body scutellation, neck-ring, and disposition of pores of *Holbrookia*. *Uta* differs from both genera, however, in having the scales of the tail much enlarged, calling to mind the same appendage of *Crotaphytus*.

Uta stansburiana, one of the most beautiful and graceful lacertilians peculiar to North America, has the slender and elongated tail provided with large, vertically arranged scales, and the lower surface of the neck with a transverse sub-lingular fold in addition to the pectoral. The color above is blackish-brown, marbled with lighter dots. Below it is of a uniform greenish-yellow, variegated with brownish-yellow bands. Stansbury's *uta* has a wide distribution along the Pacific coast, Lower California, the Sonoran region, Nevada, and the valley of the Great Salt Lake. Within this territory are also found about half a dozen other members of the genus.

Dipsosaurus is another western genus, and has but a single species, *D. dorsalis*, specimens of which have been captured along the Colorado and in Lower California. On being surprised, this animal carries its body high above the ground, and, elevating its tail like a squirrel, scampers over the sand to its burrow with great celerity.

The genus *Crotaphytus*, which has the head covered with small polygonal plates, the jaws, pterygoid, and palatine bones armed with teeth; the auditory aperture broad; the femurs provided with pores, and the tail extremely elongated, is peculiar to North America, and resembles *Holbrookia* in the general arrangement of the teeth, and in having but a single occipital plate, though it differs in having the external auditory apertures open. *C. collaris* was the first published species, and was described from specimens collected by members of Long's expedition. It is now known to inhabit the central region of the West, as far north as 40°. It is one of the most active species of the group, and is quite difficult to capture alive. Dr. Coles endeavored to keep several in confinement, but they proved untamable, and "not only defended themselves with spirit and vigor, by biting when handled or irritated, but sometimes assumed the offensive, leaping to attack to the full length of the cord which confined them. Their behavior was in striking contrast to that of the horned frogs picketed with them. The lizards lay sullen, but not cowed, watching every

movement of the persons around them with glittering eyes, ready to spring upon an intruder without warning. They clung tenaciously to a stick or the finger, in which they might fix their teeth, and suffered themselves to be suspended in this manner for some time before relinquishing hold. Now and then they seemed to have a fit of ungovernable rage, during which they leaped aimlessly about, and tugged persistently at the cord. They refused to eat, apparently from pure chagrin, and all died within a few days." *C. wislizenii*, inhabiting the country further west to the Pacific, and south into Mexico, is closely allied. It probably lives on smaller lizards, as a species of *Cnemidophorus* has been dissected from the stomach of one. *C. reticulatus* inhabits western Texas. I learn through Dr. Yarrow that both species of *Crotaphytus* are eagerly sought after by the lower classes of Indians of western Utah and eastern Nevada. To capture them the Indians employ a long switch armed at one end with a hook, which is generally made from a bent nail or piece of wire. With this instrument the lizards are drawn from their burrows and then tied up with other unfortunates. In the National Museum are several of these hooked sticks, some of which are from the Apaches of New Mexico.

Uma has the ears distinct; the palate without teeth; the infraorbital plate very



FIG. 244. — *Crotaphytus wislizenii*.

long; the imbricate labials oblique, and the claws long, slender, and straight. *U. notata* is of a light pea-green color above, spotted with darker green, and beneath white. It is a small form, the body being about two inches in length, in rare cases found in the Mohave desert. *Sauromalus ater*, the alderman-lizard, though rare in collections, abounds on Angel Island, in the Gulf of California. It is a large and stout animal, sometimes exceeding a foot in length. The head is nearly as broad as it is long, and the tail does not equal the body in length. Though the young are quite gayly ornamented, the adults are of a reddish dirt-color. *Callisaurus draconoides* is represented by three varieties, which are known respectively as the Californian dragon, inhabiting southern Lower California; the spotted-tailed dragon, found around Sonora; and Gabb's dragon, which inhabits the northern portions of Lower California. The ear openings prevent the members of this genus from being confounded with those of the next.

The genus *Holbrookia* was dedicated to the American herpetologist, Dr. J. E. Holbrook, in 1850, by Girard, and includes a small lizard of most interesting structure, though of only ordinary aspect. Its resemblance to *Crotaphytus* is destroyed

by its having no auditory aperture, and it is a much more stumpy as well as a smaller animal. There are no teeth on the palatine bones; a fold of skin crosses the pectoral region, and only femoral pores are present. *II. maculata* is rather short and thick; more so in the female than male, the entire length being between three and four inches. The tympanum is covered by scales similar to those of the neck. Running across the lower jaw from the angles is a fold of skin, smaller though parallel to the second or pectoral. The general color is olivaceous brown, passing into dim violet on the sides of the head, and ornamented on the back and sides by dark-brown blotches.

Holbrook's lizard is found in the central and southern portions of the west, where it inhabits the burrows of the prairie dog, *Arctomys ludoviciana*. *II. propinqua* and *texana* are more limited in their distribution, being only found in Texas and the neighboring portions of Mexico.

We now come to the more depressed members of the family, which, having the legs short and appended more to the sides, give the animals a toad-like appearance. They are mostly terrestrial, hiding in pits and holes of the ground, usually selecting stony and sandy localities.

Few lizards are better known as objects of curiosity than those popularly called, at home and abroad, 'horned or California toads.' From their odd appearance they at once attract attention; and having a most quiet disposition, seldom offering to bite, and soon becoming accustomed to domestic life, they are seized upon as pets by travelers, and have even been used as jewelry, being tethered by a slender chain to a breast-pin. Not only are they interesting from their habits while domesticated, but many of their ways in nature are strange and unusual. There are no less than nine different species of these animals inhabiting the country west of the Mississippi, from Mexico to Dakota, all being included under the single generic title *Phrynosoma*, indicative of their toad-like appearance. No genus of the order is more easily recognized than this. The body is more or less circular in outline, extremely depressed, and covered above with spine-like scales, which extend on to and cover the short conical tail. The solid sub-triangular head is provided with carina over the eyes, which are thus placed in a groove and are minute. Strong horny spines are often developed from the superciliary and temporal regions, as well as across the occiput. The pyramidal scales of the back are greatly developed in *P. cornuta*, an animal which presents a most roughened and spiny appearance. In *P. platyrhinos* and *modestum* the body is quite smooth, and destitute of the roughness generally characteristic of the group. The scales of the lower side of the neck and body are important in characterizing the several species. On the breast and anterior portion of the shoulders the largest scales appear, being here very prominent, acute posteriorly, and provided with strong ridges or keels. The relative portions of the thighs are similarly protected, though with much weaker scales. The legs are of about equal size, and used not for jumping, but for running; the popular name "toad" being given more because of the animal's general appearance than from any relation to the Batrachians. Though the anal pores are absent, those of the thighs are present, and of different numbers in the several species.

Phrynosoma douglassi is wide-spread over the entire western plains, extending its habitat from British America into Mexico, and presenting two accepted varieties; the coloring of different individuals from different localities shows considerable variation, ranging from a uniform brown shade above, to a spotted or barred ornamentation; infrequently the sides of the head are red. Below, the color may be of a

uniform pale gray, or blotched with brown. The young individuals are also different from the adults, being of a more uniform and lighter color. The color of all *Phrynosomas*, however, is due to a greater or less extent to the color of the soil on which they live. Probably no reptile presents this peculiar adaptation more than do the representatives of this genus; often so accurately are the surrounding shades of color counterfeited that it is impossible to distinguish the reptile. This coloration, moreover, is not simply transitory, as in the chameleons and other lizards, but is more permanent, and only changes after the animal has been placed on a new soil for a considerable length of time. In confinement, which may be easily effected by tying a small string to the animal's horns, it is a most inoffensive creature, and though the larger ones may at first offer a little resistance on being captured, they soon, with care and kindly handling, become accustomed to a domestic life, and may become quite tame



FIG. 245. — *Phrynosoma orbiculare*, horned-toad.

and live for months. They have been known to take milk and flies from the fingers of their keepers. They are most bashful animals, when they think they are being observed, as well as when roughly treated, depressing their bodies, and with closed eyes feigning death to perfection. A little tickling along the side will bring them to life, however, and please them hugely, they expressing their fondness for the operation by inflating themselves until they are nearly spherical. They also seem particularly pleased if the rain is allowed to fall upon them. This contentment is only transitory, however, for no sooner is their keeper lost to sight than they try some plan of escape; shuffling away with a rapid gait, or seeking concealment by drawing the limbs to the body, depressing the head, and with a few wriggings, disappearing into the earth. *Phrynosoma orbiculare* is a Mexican form.

It is said that the horned toads have special aversion for dogs, on the sight of one, puffing up their body, lowering their horns in a most ludicrous manner, and hissing like a turtle. Their food consists of flies and other small insects, ants being particular

favorites. All *Phrynosomas* are viviparous, the female giving birth to seven or eight young at a time.

The XENOSAURIDÆ is an intermediate group between the Iguanidæ and the Anguidæ. *Xenosaurus grandis* is of about ten inches in length. The head and legs are covered with close, rounded, smooth tubercles, which on the tail are arranged in regular rings. On the under side, the scutellation is made up of smooth and rather elongated scales, which diminish in size posteriorly. Thus far it has only been captured in Mexico and is probably of nocturnal habits.

The family ZONURIDÆ as now defined contains only three genera, *Zonurus*, *Platysaurus* and *Chamaesaura*, all of which are South African, and resemble each other in having the tongue simple, as well as in several osteological particulars.

Zonurus microlepidotus is represented by several local varieties, all of which prefer the more rocky localities, perpendicular precipices being the favorite haunts of some. They wander about on the narrow shelves in search of insects, or of some particularly warm niche, where they can doze in the sun's rays unmolested. On being disturbed, concealment is quickly found under some rock or in a narrow crevice, where, aided by the prominences on the hinder edge of each temple, they so secure themselves as to make it almost impossible to extricate them. *Z. griseus* is also a very abundant form, and is widely distributed over southern Africa, where there is scarcely a stony knoll or rocky retreat which does not afford habitation for one or more. The colors of the individuals vary exceedingly, no two being similarly ornamented.

Platysaurus has the tail but poorly armed, and in general appearance is much more elegant than the previous genera, which, however, it agrees with in its choice of habitat, and in retreating, on being disturbed, into crevices and under stones, where it is enabled, by its long, hooked claws, to retain a powerful hold. Its food is chiefly composed of insects.

Chamaesaura anguina has an elongated, angular body, covered with lengthened scales and ornamented with longitudinal bands. Though provided with limbs, they are of a most rudimentary character, being extremely small, and, instead of having digits, each ends in a simple point. They are of no use in progression, and are simply organs atrophied by disuse. *C. anguinea* is found in the more moist localities among grass or stones, and in the vicinity of water. Though without feet, it is, by assuming a serpentine movement, able to progress with great rapidity.

The ANGUIDÆ includes a number of both Old and New World lizards, which are characterized by several peculiarities of the bony framework, as well as in having the anterior portion of the tongue retractile.

The genus *Anguis* has the body greatly elongated, serpentine, and terminated by a lengthened tail. No appendages are present, and the shoulder-girdle, sternum, and pelvis are rudimentary. The eyes are provided with movable lids and the ears are concealed by the overlying skin. *A. fragilis*, the orvet or blind worm, inhabits Europe and a portion of Asia, and was considered by Cuvier to be a serpent, so much like these reptiles is it in its general appearance. In England it is very abundantly found in the more retired localities, where it can pursue its prey unmolested, though it is occasionally seen along the roadside, where its bright glossy body and shining black eyes at once attract attention. From a popular mistaken notion, the harmless animal is seldom made a pet of, it being considered poisonous. It has, however, proved to be an extremely interesting animal in captivity, though it is only with the exercise of considerable patience, that it can be made to accustom itself to its

new surroundings, and not break off its tail on the apprehension of danger; a piece of self-mutilation which is often resorted to, in out-door life, as a means of escape. The animal is beautifully colored with red scales edged with white, and ornamented along the sides with stripes of dusky brown. The adults seldom exceed the length of twelve inches.

Though slow and deliberate in its movements, there is no reason for calling this lizard a 'blind-worm.' The eyes are well developed and are indispensable to an animal of insectivorous diet. The young, which are very hardy, are brought forth alive, and to the number of six or eight.

Allied to *Anguis* is the *Ophiodes* of Brazil, an animal having the hind limbs represented by a pair of short, flattened, undivided, and pointed appendages, springing from each side of the abdomen, and with eyes protected by movable lids. The genus *Barisia* is found in Lower California and Mexico. It is peculiar in having no single frontal plate. *B. olivaceus* is dark olive green, with bars of dusky brown, and beneath greenish white. *Gerrhonotus* is represented in the more western portions of the country by several species, of which *G. nobilis*, inhabiting New Mexico and Arizona, is, though of small size, one of the most beautiful. The body is slender and elegant, supported by graceful limbs, and of a clear olive color. It is more or less spotted with black, and crossed, from the occiput to the tail, by nine or ten transverse, brown bands. *G. principis*, the Oregon lizard, has been captured in the Pacific region, though it is rare. *G. multicarinatus*, the many-keeled lizard, is perhaps the most abundant species. It is a slender and graceful animal, inhabiting the Pacific and Lower California regions, and is characterized by having sixteen longitudinal rows of strongly carinated scales extending along the back. The color is yellowish green, irregularly banded with narrow, brownish lines.

We now come to one of the most interesting of American lizards, the *Ophiosaurus ventralis*, inhabiting the warmer portions of the United States, east of the Mississippi and south of the Ohio River. It chooses the drier localities, where it often burrows into the soil, spending much of its time underground, and about the roots of old trees. It is said to be quite frequently brought to light by those digging sweet potatoes. Though destitute of feet, this peculiar lizard is able, by its serpentine movements, to retreat, on being disturbed, with considerable swiftness, and is seldom captured without injury; for the tail, the vertebrae of which are but poorly articulated, is so brittle as to break off at the slightest blow. This fragility has given the animal the popular name of 'glass-snake.' In coloring it is, above, of a yellowish green shade, lined with black. Below it is yellow. The snout is long and pointed, the ear-pits large, the eyelids well developed, and each flank is provided with what is ordinarily a deep groove, but which, on the animal's swallowing some large object, appears as a tract of elastic skin, the rigid skin of the body generally being incapable of expansion. The tail is cylindrical and elongate, being about twice the length of the body. The popular belief that the tail, when broken from the body finally becomes attached again, is explained by the fact that a new one soon grows out.

The family ANIELLIDÆ, including the Californian genus *Aniella*, is probably degraded from the Anguidæ. *Aniella* is destitute of limbs. The nasal shield is so bent at its lower edge as to form a part of the labial margin, and inside of it is the labial shield proper. *A. pulchra* is a most graceful and elegant creature, smooth and glossy, and with the upper portions ornamented with narrow, brown, zigzag lines, passing the length of the body.

The HELODERMATIDÆ includes the largest North American lizard, the Gila monster, *Heloderma suspectum*. This animal, whose habitat is New Mexico, Arizona, and the country lying southward, is, because of its poisonous nature, as well as from its large size and peculiar ornamentation, a common object in the larger zoological collections and menageries, where it thrives on eggs, and at times wakes from its ordinary stupor and is quite lively. In its native haunts it attracts attention by its strange coloration, as it is of a deep black, ornamented with irregular blotches of orange, and covered by a thick and rigid coat of small horny tubercles and scales.

Though the more incredulous scientist has questioned the character given this animal by the superstitious Indians and Mexicans, who regard it with the utmost fear, maintaining that it possesses venom of a most virulent nature, a test was recently made by Dr. Shufeldt, which is of considerable interest. He says, in giving an account

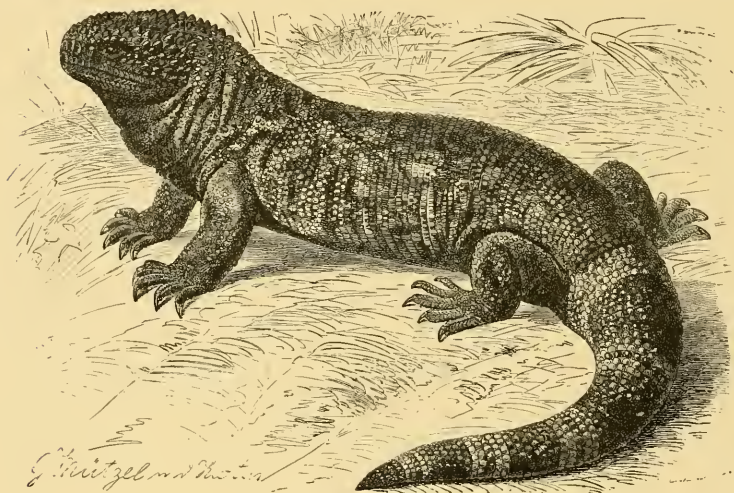


FIG. 246. — *Heloderma horrida*, Gila monster.

of an animal at the National Museum: "It was in capital health and at first I handled it with great care, holding it in my left hand, examining special parts with my right. At the close of this examination I was about to return the fellow to his temporary quarters, when my left hand slipped slightly, and the now highly indignant and irritated *Heloderma* made a dart forward and seized my right thumb in his mouth, inflicting a severe lacerated wound, sinking the teeth in his upper maxilla to the very bone. He loosed his hold immediately, and I replaced him in his cage, with far greater haste, perhaps, than I removed him from it.

"By suction with my mouth, I drew not a little blood from the wound, but the bleeding soon ceased entirely, to be followed in a few moments by very severe shooting pains up my arm and down the corresponding side. The severity of these pains was so unexpected, that, added to the nervous shock already experienced, no doubt,

Varanus salvator, water monitor, kabarangya.



and a rapid swelling of the parts that now set in, caused me to become so faint as to fall, and Dr. Gill's study was reached with no little difficulty. The action of the skin was greatly increased, and the perspiration flowed profusely. A small quantity of whiskey was administered. This is about a fair statement of the immediate symptoms; the same night the pain allowed of no rest, although the hand was kept in ice and laudanum, but the swelling was confined to this member alone, not passing beyond the wrist. Next morning this was considerably reduced, and further reduction was assisted by the use of a lead-water wash.

"In a few days the wound healed kindly, and in all probability will leave no scar. All other symptoms subsided without treatment, beyond the wearing, for about forty-eight hours, so much of a kid glove as covered the parts involved.

"After the bite our specimen was dull and sluggish, simulating the torpidity of the venomous serpent after it has inflicted its deadly wound, but it soon resumed its usual action and appearance, crawling in rather an awkward manner about its cage."

Dr. Shufeldt's conclusions, however, that the symptoms were no other than usually follow the bite of an irritated animal, seem to be given a little prematurely. The same reptile was afterward induced to bite the edge of a saucer, into which, during the action, a secretion dribbled. This secretion, which was of a distinctly alkaline nature, in contrast to the serpent-venoms, which are acid, was, in a small quantity, injected into the breast of a healthy pigeon, and produced death in seven minutes. On a second trial a small quantity was injected into the carotid artery of a rabbit, the animal dying in one minute and thirty-five seconds. Different from the action of serpent-poison, which affects the respiratory functions, the poison of *Heloderma* attacks the heart and the spinal cord. The power of this portion of the nervous system to respond to even powerful electric currents is abruptly annihilated.

The family of water-lizards, the *VARANIDÆ*, contains some of the largest animals of the order. They are chiefly semi-aquatic, their elongated bodies and compressed tails enabling them to swim with considerable power. Much of their time is spent on shore however, and, though less active than when in the water, they are lively and agile, several species being partly arboreal. All are carnivorous, feeding on different water animals, and on the eggs of birds as well as those of the larger reptiles. Just below each valvular nostril is a cavity of considerable size, from which the animal can obtain a limited supply of air when below the surface, where it often remains for considerable periods of time. Representatives are found in Africa, their true home, and in Asia and Australia. They resemble each other, and are characterized by having the snout produced, conical, and covered with non-imbricate shields; the teeth acute and compressed, and the tongue slender, terminating in a fork, and retractile into a sheath at its base. The scales of the back are small, equalling in size those of the sides, and arranged in cross-rows; those of the belly and tail being square and arranged in bands. The tail is long and generally compressed, and the toes are five in number and provided with strong claws.

The Indian water-lizard, *Varanus dracena*, sometimes exceeds the length of four feet, the tail being longer than the body. The natives use the flesh for food, the animal being quite abundantly found along the low lands, where dogs are trained to hunt it. It is more or less subterranean in its habits, spending most of its time in its burrows, though during the warmer portions of the day it wanders out, after smaller reptiles and in search of ant-hills. *V. albigularis* inhabits South Africa and sometimes reaches a length of four or five feet. It prefers the more rocky localities, seeking

safety, on being disturbed, in the crevices, where it so clings on to the irregularities of the sides as to make its capture almost an impossibility. If it be dislodged, however, it flies at its enemy with the utmost fury, not infrequently compelling it to retire. The reptile's food consists of frogs, crabs, and small quadrupeds, for which it is often seen lying in wait beside some spring or brook of running water. The superstitious natives, who greatly dread the animal from a mistaken belief that it is poisonous,



FIG. 247. — *Varanus niloticus*, monitor.

noting this semi-aquatic habit, have become possessed of the idea that the animal is sacred, and, if injured, has the power, by way of revenge, of producing drought.

The monitor, *V. niloticus*, has the elongated tail with a double-edged keel above, and the teeth rounded. As its name implies, this animal is an inhabitant of the Nile, in which it spends most of its time, seldom going on shore except to search for crocodile's eggs, of which it destroys large numbers. It is, in fact, a most important animal, as it keeps these furious monsters from multiplying to an undue extent, by waging a constant war against them, not only by breaking open their nests and eating the

eggs, but also by following the young in the water, where it can easily capture them, being a most active swimmer. When full grown, the monitor — called so from the notion that the animal gives an alarm on the approach of any poisonous snake — not infrequently reaches the length of five or six feet. *V. salvator* even grows to a greater length. It is an inhabitant of India, and is also abundantly found in the more marshy localities of the Malayan peninsula, where it is often seen among the branches of trees overhanging some stream or pond, in search of young birds or lizards, and from



FIG. 248. — *Teius teguexim*.

which, on being disturbed, even though it be at a considerable height, it plunges into the water and quickly swims away to its hole under some neighboring bank; from which it is only too often dug out for food by the lower Hindus.

The family XANTHUSIDÆ is closely allied to the Teiidae, though it differs in having the tongue but slightly incised, and the skull of a different structure. The family includes but a single genus, *Xantusia*, which has a slender, cylindrical body, femoral pores, three folds of skin on the throat, the pupil vertical, and the eye unprotected by lids. A single species, *X. vigilis*, inhabits Lower California.

Of the TENIDÆ, all the representatives are New World forms, while the related acrodont Lacertidæ are confined to the Old World. The genus *Teius* has five toes on each foot, the femoral pores distinct, and the throat with two cross-folds, between which are the larger six-sided scales. In the young individuals, the teeth are plurident, pectinate in front, and three-lobed on the sides, but as the animal increases in age the bone of the jaw grows up and around their bases, and the front teeth become more rounded.

T. teguixin, or the variegated-lizard, as it is called by some, in allusion to the disposition of its colors, is of a green shade varied with black, and ornamented with two series of white spots on the upper part of each flank. In some localities it is called the safeguard-lizard, from the attributed habit of giving an alarm on the approach of alligators, in the same way that the monitors of the Nile are said to make known the presence of serpents. It is an animal of considerable size, sometimes reaching the length of five feet, and, being bold and strong, is, when provoked, no ordinary enemy. It inhabits the more retired situations of tropical Brazil, where it finds an abundance of the small reptiles and insects on which it feeds.

Ameiva has the ventral shields broad and smooth; the tongue elongate and sheathed at its base; the teeth compressed, and three lobed, and the feet ending in five toes. Several species inhabit the more tropical portions of the New World. *A. dorsalis*, the ground-lizard, is one of the most abundant reptiles of Jamaica, where it is often seen by the road-side, as it is scratching in the sand, or peering out from behind some fallen leaf. Always restless and active, it sometimes shoots along over the short grass with such rapidity that it seems to fly. It is met with everywhere, not only along byways, but in open pastures and cultivated fields, its beautifully colored body, bright green eyes, and gentle manners rendering it a universal favorite in spite of all prejudices.

Allied to *Ameiva*, but having the tongue free at the base, is *Cnemidophorus*, a genus represented in the United States by a dozen species, the most of which inhabit the Rocky Mountains, though *C. sexlineatus*, the six-lined or striped-lizard, is abundantly found in the southern states as far north as Virginia, and extending west into Mexico. It is a lively little animal, running about on the ground with great swiftness in search of insects, and often in the neighborhood of plantations, where its prey abounds. It is a timid animal, however, seldom wandering far from its retreat, and is more or less crepuscular, being seen, the male and female often in company, towards the close of day. The ordinary length is about ten inches, of which the tail is more than half. The animal is dark brown above, marked with six yellow longitudinal lines, all but two of which disappear on reaching the tail, which is roughened by the carinated scales. Below, the scales are smooth, and of a silvery-blue color.

C. tigris, inhabiting the Pacific slope, Utah, and the country lying south, has four yellowish indistinct stripes along the dorsum, and while the back and upper portions of the legs are covered with only minute scales, those of the lower side of the body and legs, as well as those of the throat, are large and strong. On the tail, which is cylindrical, and two and one half times the length of the body, the scales are of a third character, being longer than broad, arranged in annular rows, and more or less carinated.

The family AMPHISBENIDÆ contains some of the most degraded lacertilians, though they have points of structure which connect them with the previous family.

The snake-like body is unprotected by scales except in the region of the head and throat, and the skin is divided by closely arranged, transverse constrictions, and by more shallow longitudinal furrows into oblong divisions, which give the animals, often assisted by their peculiar color, a mosaic-like appearance. The pectoral girdle is very rudimentary, except in a single genus, and the sternum is never present. The pelvic arch is represented by rudiments, though it never bears appendages. The bones of the skull are firmly articulated together, and the rami of the lower jaw are united in front by an unelastic symphysis. The eyes are small and, like the ears, covered by the integument. The teeth may be either placed along the ridge of the jawbone, acrodont, or along the inside, plurodont.

The genus *Amphisbæna* has the teeth plurodont; two large nasal shields, behind which are two pairs of frontals; the head flat with a rounded snout; and in front of the vent a transverse row of so-called pre-anal pores. The generic name has been given because of a popular notion that the animal, which can progress in either way, is provided with a head at each end, the short rounded tail resembling the head in general outline. The sooty *Amphisbæna*, *A. fuliginosa*, is the most common species,



FIG. 249. — *Amphisbæna alba*.

and is found throughout the warmer portions of South America, where it hides in the ground, through which, like the earthworm, it tunnels its way in search of larvae. The young of ants form the chief element of its diet.

Rhineura floridana is an allied form. This animal, the only native member of the family, has been many times captured in Florida, where, from its habit of leaving its subterranean home and coming to the surface after thunder showers, it has received the name of 'thunder-worm.' It is of a dirty white color, on the upper surface of the head becoming yellowish.

Also of subterranean habits, though differing from the other members of the family in having a pair of small limbs terminated by five toes, is *Chirotes*, a genus inhabiting Mexico and Lower California. The head is no larger than the rest of the body, the teeth are conical and slightly recurved, and the tongue, like that of the woodpecker, is tipped with horn. On the abdomen is a row of pores resembling those of *Amphisbæna*.

We now come to an Old World family, the LACERTIDÆ, which is represented by several genera.

Pseudopus is found in Europe and southern Asia. It has the body long and snake-

like, the quadrangular scales arranged in transverse series, and the limbs absent or represented by a single pair of appendages, unprovided with toes and placed at the posterior portion of the abdomen. *P. pallasi*, a timid animal inhabiting the more central portions of Europe and Asia, seldom wanders far from its retreat, to which it quickly retires on the slightest apprehension of danger. It is said to be especially fond of dark, wooded glens, where it can find the nests of smaller birds, feeding to a considerable extent on their young. In its marking it is dull brown, a shade which well harmonizes with its usual surroundings. *P. gracilis*, the Khasya glass-snake, is a closely allied form inhabiting the Khasya Hills of India, but differs in being unprovided with even the rudiments of limbs. Like other lizards having a longitudinal fold of skin running along the sides, the scaly covering of the back and abdomen is so rigid that it prevents the general distention of the body so characteristic of serpents

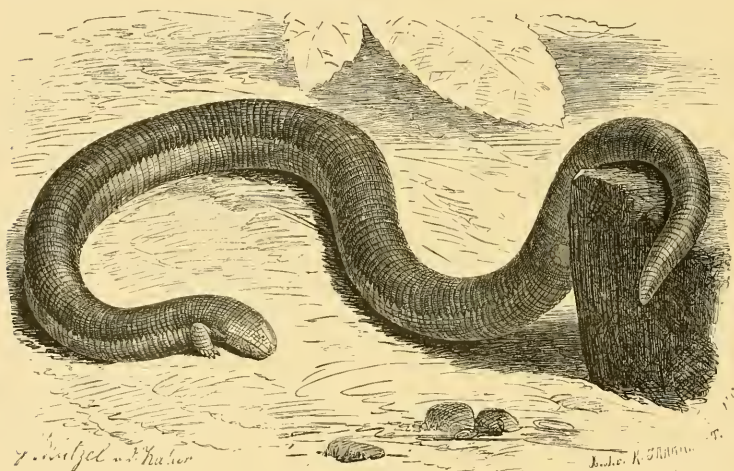


FIG. 250. — *Chirotes canaliculatus*.

and some lizards; food, however, of considerable size is allowed to enter the body through the elasticity of these lateral folds, extensibility being here limited to a special area, like that of *Ophiosaurus*.

The genus *Lacerta* is abundantly found in the warmer portions of the Old World. These lizards are diurnal in their habits, the eyes being provided with connivant lids; and they run about over rocks and prostrate logs, seldom or never attempting to lead an arboreal life. The scales are non-imbricate, simply appressed, and the limbs are four in number and well developed.

L. agilis is a most familiar object of the country in England, as well as on the continent, being popularly known as the gray or sand-lizard. In the warmer portions of Europe these inoffensive creatures are very abundant; and, though of fair size, being sometimes ten inches in length, they are extremely agile, their movements being so rapid that the eye can with difficulty follow them, as they scamper away over the

ruins and debris. They are said to live in pairs; the father and mother, while having considerable mutual regard, assuming a most indulgent disposition towards their often wayward offspring, leading them to situations where they may be warmed into activity by the sun, or sheltering them from the cold. All, at the beginning of winter, dig for themselves little cavities in the earth, in which they coil up and sleep until the approach of spring. *L. viridis*, the green-lizard, is found in Jersey and localities around the Mediterranean; a most beautiful animal, inquisitive, confiding, sprightly, and courageous, it is always watched with interest. *L. muralis* is abundant about the ruins of southern Europe and on the islands of Sardinia and Malta.

Zootoca vivipara is peculiar in that the eggs are hatched while in the oviduct.

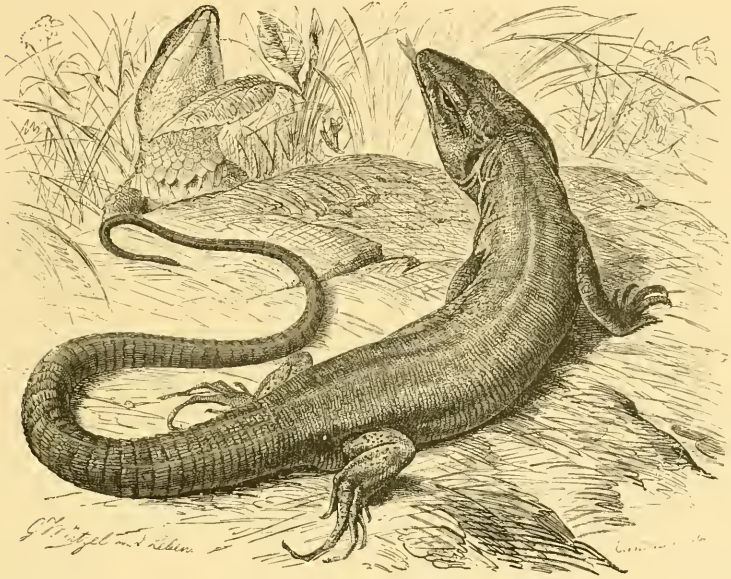


FIG. 231. — *Lacerta viridis*, green-lizard.

It is a very abundant animal throughout England, being particularly fond of heaths and warm banks, where the female is said to lie in the sun for some time before the young are born, that the eggs may be incubated by its warm rays. The scaly-lizard, as this animal is popularly known, is very active; and, being quite sharp-sighted, its capture is anything but an ordinary occurrence.

Trachysaurus rufosus is one of the most peculiar creations of nature. The head is short, pyramidiform, and distinct from the short, thick neck. The trunk is elongated and bulky, and the tail is short, large, flat, and rounded at the end, and so abbreviated as to appear at first sight to be a mere remnant, the rest seeming to be lost by some mishap. The short, thick legs, terminated by toes which are armed with

stout nails, are too small to allow the animal any very rapid movements, the chief source of protection being in the hard, thick tuberculate shields which cover the entire upper side of the body, though below they become thin and smooth. About this strange animal's habits but little is known. It has been captured in western Australia.

The family GERRHOSAURIDÆ includes but a single genus. *Gerrhosaurus flavigularis* is a slender lizard, inhabiting South Africa, of about twelve inches in length, and colored above with yellowish-brown, striped and banded with lighter and darker shades. Localities covered with a thick growth of underwood seem to be the most often chosen, the animals, on apprehending danger, concealing themselves by burrowing under the dead leaves or loose earth. Specimens are distributed over a wide area,

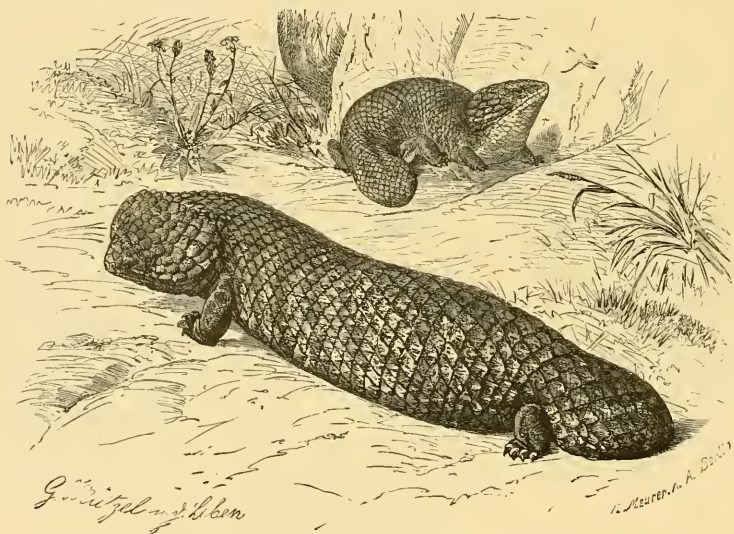


FIG. 252. — *Trachysaurus rugosus*.

from Cape Colony as far north as the Tropic of Capricorn. *G. bibroni* inhabits the shaded ravines of the Orange River, while *G. typicus* prefers the dry plains, over the sand of which they scamper with most extraordinary rapidity, it being almost impossible for the eye to follow them in their flight. They are also active burrowers, and, on being disturbed, often conceal themselves in the loose sand, though only to a moderate depth.

SCINCIDÆ includes a large number of terrestrial lizards inhabiting the more tropical countries generally, and protected by a covering of smooth bony plates, which, on the crown, are regularly arranged, like those of serpents. Skinks are found secreted under old logs, bark, and dead leaves, or in shallow burrows in loose earth. They are oviparous, and the eggs, to the number of ten or a dozen, are hid away in those situations.

The genus *Cyclodus* has the scales thick and round, the body with four short, five-toed extremities, and terminated by a rounded tail. The lower eyelids are scaled. *C. gigas*, of Australia, is one of the largest members of the sub-order.

Scincus has the body elongated and provided with four limbs, each bearing five-fringed digits; the head elongated and flat; palatine teeth present; openings of the nostrils in the middle of the triangular supranasal shield, and the under eyelids covered with scales. Though once made to include several species, there is now but a single representative. The common or officinal-skink, *S. officinalis*, is a native of south Africa, and inhabits the more sandy localities, where, by means of its peculiarly shaped feet, it so quickly buries itself beneath the surface, on being surprised, that it seems to glide into an already formed burrow. Though the limbs are well developed, the animal is only an ordinary walker, seldom wandering from its chosen locality, and then only in search of small insects. To bask, half asleep and undisturbed, in the



FIG. 253. — *Scincus officinalis*, common skink.

sun, seems to be its chief delight, and, when thus indulging itself, is often quite indifferent as to what may be going on around it. It has been named 'officinal' because of the high esteem in which it was held by the medical quacks of the middle ages; its body, dried and reduced to a powder, being thought to possess the most wonderful virtues, and was prescribed as a specific for nearly every disease of the human body.

The genus *Scps* has the body much more elongated than *Scincus*, the limbs are terminated by only three toes, and the lower eyelids are transparent. The legs are very weak, and are used but little as organs of locomotion, the animal being more snake-like in its movements. Its teeth are small and simple, on the jaws only, and adapted to seizing and retaining small insects, worms, slugs, and the like. *S. tridactylus* is of a gray color, striped with four longitudinal rows of appressed brown dots. To this harmless animal, which inhabits the regions bordering on the Mediterranean, have the ancients given a most frightful character. They maintained, and the belief

is still current in some localities, that the seps would enter the shelters of cattle, and, while these animals were asleep, would inoculate them with a most corrupting poison. This attributed habit has given them a name which signifies, in the Greek, corruption. *S. chalcides* inhabits Dalmatia.

Acontias has the legs entirely absent, the upper eyelid rudimentary, and no abdominal pores. The type species, *A. meleagris*, is a south African animal, where its habits are strikingly like those of the European blind-worm. It is possible that a second species of this genus inhabits Ceylon. *Nessia* is an allied genus, having four rudimentary legs, and represented by two species; *N. burtonii*, having the feet divided into three minute toes, and *N. monodactylus*, having the toes undifferentiated. These small animals resemble the rhinophid snakes in their habits and general mode of life, though their habitat is much more restricted, the genus having been found only on the island of Ceylon.

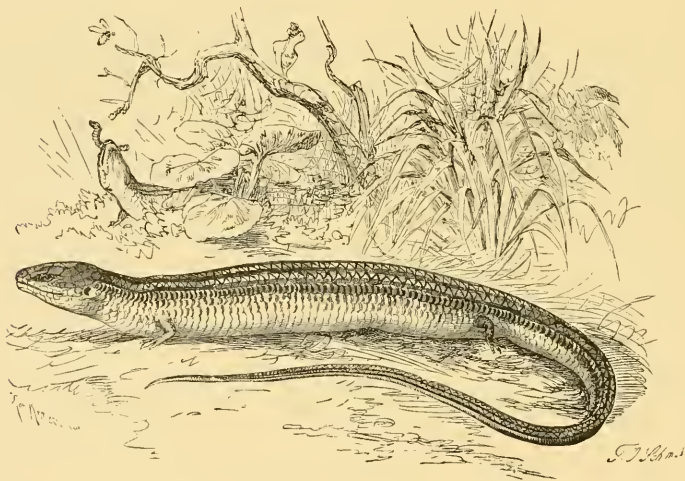


FIG. 254. — *Seps chalcides*.

The ground-lizard of the southern states (*Oligosoma laterale*) is in its habitat a most familiar animal. While wandering through the woods of Louisiana, the noise these little animals made as they scampered away was truly astounding. Not being acquainted with them, my first impression was that I had disturbed a colony of beetles; but my mistake was soon apparent, for these reptiles were by far too abundant for all, on being surprised, to find immediate shelter. If captured, — a by no means easy task, — they make no violent effort to escape, but, with a most droll expression, they eye their captor; soon winning his confidence, but betraying it at the most unexpected moment, for with a quick struggle the tail is dropped off, and, before one has recovered from his surprise, no lizard is to be seen, the tail only remaining, which for some little time twists about with as much vigor as when attached to its owner.

This self-mutilation of the lizard offers a remarkable instance of protection. It

will be seen that the animal, being comparatively slow of foot, cannot ordinarily seek safety in flight, and having no organs of defence, it, on being attacked, breaks off a portion of its tail, which, still alive and twisting about by reflex action, attracts the attention of the enemy, and the lizard, unencumbered and unnoticed, glides into some crevice, and is safe. The muscles of the tail are so arranged that they, by contraction, close over the place of amputation, and bleeding is prevented. From the thus blunted appendage a new rudiment soon appears, which, in a short time, replaces the lost part. It is stated, however, that the new growth differs from the original in having the vertebrae represented by an unsegmented cartilaginous rod.

The ground-lizard is, above, of a dark, shining, brown color, well harmonizing with the shades of soil, dead wood, and roots on which it abides. Along each side, running from the eye above the insertion of the legs, is a black line, below which the coloring lightens, the free skin of the throat being pink, shading into yellow along the abdomen, and passing into a beautiful blue further back. Its more restricted habitat is in the thick forests of oak and hickory of the Carolinas, Georgia, Florida, and the gulf states.

The genus *Eumeces* is very abundantly distributed over the warmer portions of the globe, the United States alone having over a dozen species, and is characterized by having the scales thin, smooth, and polished; the tail fusiform and smooth; the nostrils piercing a single plate; palatine teeth absent, the limbs well developed, and each provided with five toes. Some species have the lower lids transparent.

Eumeces fasciatus, the blue-tailed skink, is the best known of the genus. Not only is it abundantly found over a large area throughout the more central, southern and eastern portions of our country, but it is a wanderer, coming to light not infrequently in remote situations. In coloring it is, above, of a deep, glossy green, ornamented with fine, narrow, yellow, longitudinal lines passing, on the tail, into a beautiful ultramarine, a shade which is also adopted by the lines. Below, the animal is of polished, pearly white. The total length is between eight and nine inches.

The blue-tail is a lizard which secretes itself between the loose bark of some tree, and there lies in wait for small Coleoptera and grubs. Though it is a good climber, it does not habitually ascend trees, but may wander unrestrictedly through the dark interior galleries of those monarchs of past ages which are occasionally met with in the midst of wild southern forests. During early morning, or dark days, when partially chilled, the animal, though at other times so active, is indifferent and helpless, often two or three individuals being found together, buried in the rotten wood at the base of a stump, or in a hollow below some prostrate log.

A near relative, the Bermuda skink, *E. longirostris*, is the only living representative of the order in this isolated group, though it is possible that at some early date there existed larger species, like those of the Galapagos. Captain John Smith, in speaking of these islands in 1624, says, "Lizards there were many and very large, but now none, and it is said they were destroyed by the Cat." A still earlier writer, however, Rev. Lewis Hughes, in 1614, says, "Here is no kind of beast but hogges and eates and they but in one or two places which we thought to come at first by means of shippe-wracke. The hogges were manie, but are now brought to a small number."

In enjoying the sunshine, and in making a quick retreat, on being disturbed, as well as in several other peculiarities of habit, the Bermuda skink resembles its better known brothers of the continent.

E. skiltonianum, Skilton's skink, inhabits the Pacific region, and has the body greatly elongated, the tail, which is more subquadangular than conical, being about twice the length of the body. The limbs are small, and the scales, though elsewhere smooth, on the back and tail present four or more longitudinal furrows or stripes. *E. anthracinus* is found in the more mountainous regions from Pennsylvania to Texas. *E. egregius* and *onocrepis* inhabit Florida. In the more southwestern territories are several other species. The eggs of this genus are laid, to the number of ten or a dozen, under leaves, stones, or the bark of trees.

The family ANELYTROPIDÆ includes a small number of degraded skinks. *Typhline* has no limbs, and the pre-anal shield large and single. The eyes can be faintly discerned through the covering of skin. Specimens have been taken at the Cape of Good Hope. *Feylinia* is also unprovided with limbs, but has the pre-anal scales numerous. It inhabits the coast of Africa in the neighborhood of Angola.

This family includes, under the head of DIBAMIDÆ, a still more degraded genus, *Dibamus*, which has none of the osteological peculiarities which characterize the previous families. The posterior limbs only are represented, and these by mere folds of skin. The pre-anal scales are undifferentiated. Its home is New Guinea.

The members of the highest family, the CHAMELEONTIDÆ, are all natives of the Old World, and are characterized by having the tongue worm-like, club-shaped, in front, and very extensible. But a single genus, the acrodont *Chamleo*, is represented.

The chameleons have the large and angular head covered with small, flat shields; the deep and compressed body with shagreen-like skin, and the tail, characteristic, long and prehensile. The eyes are large and globular, and each can be directed towards an object of its own: the eyelids are circular and pierced by a central hole; the tympanum is hidden, and the limbs, which are perhaps the most specialized organs of a highly specialized animal, are capable of supporting the body, and terminated by feet, which are converted into grasping hands by having the five toes arranged by their union as far as the claws in two opposing groups. With the strong grasp of their feet and with the assistance of the prehensile tail, it is almost impossible to shake them off the branch on which they may be slowly feeling their way. On the ground or in the water they are almost helpless. The eggs, protected by a calcareous shell, are deposited, to the number of ten or twelve, under decaying leaves.

The singular power of changing the color of skin is not alone possessed by the members of this family, nearly all of the lacertilians having it to a more or less degree. The phenomenon is brought about by there being two layers of pigment cells underlying the transparent epidermis, the lower and darker, at the will of the animal, or stimulated by surrounding objects, predominating over and through the more superficial and lighter layer. Though the proper home of the chameleons is Africa, where there are several species, they are found along the northern shores of the Mediterranean, in Asia, and on the island of Madagascar.

ORDER IV. — CHELONIA.

The members of this order present less variation in form than do those of any other of the class. The body is invariably short and stout, and is, in all the known forms, protected from above and below by a more or less bony investment, developed ordinarily, directly from the osseous framework; though some forms may have this



Chamaeleo vulgaris, chameleon.

armature produced by a secondary growth, the hardening of certain portions of the dermal covering. In all cases the head, tail, and limbs are capable of being protruded from between the margins of the thus formed plates, and may be modified for special habits; as broad and fin-like for marine, simply webbed for inland aquatic, or short and stump-like for terrestrial life. Four limbs are always present; and the jaws are unprovided with teeth proper, being simply encased in horn, like those of birds.

As to the shield-like covering, it is of considerable importance to the systematic zoologist, often presenting most distinctive characters. By reference to the illustration it will be seen to consist of two portions, the dorsal, or carapax, and the ventral, or plastron, and to be divided into geometrically shaped portions, or plates of a horny nature, which in no way follow the outline of the underlying bones. These plates are

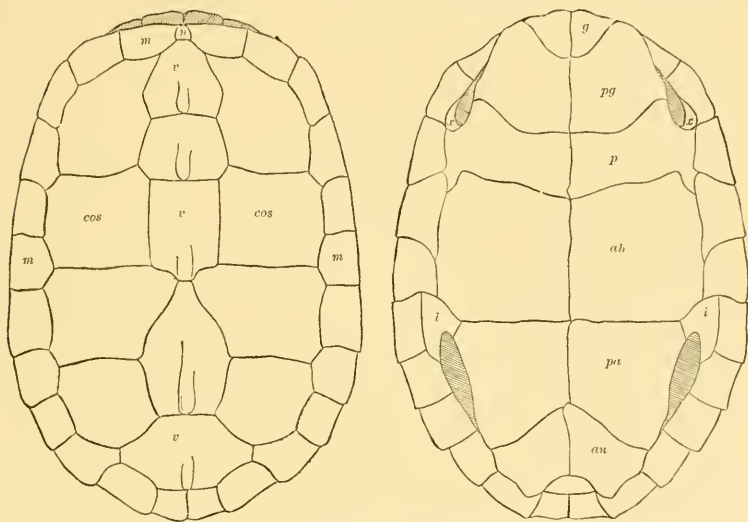


FIG. 255. — Diagram illustrating the dorsal and ventral plates of a turtle; *ab*, abdominal; *an*, anal; *c*, caudal; *cos*, costal; *g*, gular; *i*, inguinal; *m*, marginal; *n*, nuchal; *p*, pectoral; *pa*, pre-anal; *pg*, post-gular; *v*, vertebral; *x*, axillary.

of considerable commercial value in some turtles (*Chelonia*) as they are the ‘tortoise-shell’ of commerce.

From the rigid portion of the vertebral column, the expanded processes of which, together with the sutured ribs, form the carapax, the flexible neck projects, and is capable of being more or less completely retracted into the cavity of the shell. The eight vertebrae of which it consists are entirely destitute of ribs. Posteriorly, the sacral portion of the column is bent down, free from the carapax, and terminated by a flexible tail, which is, on the occasion of danger, not withdrawn under the shield, but simply bent round against the side of the body.

The bones of the head are firmly united to each other, the skull resembling that of birds, though the cranial capsule is considerably less in size. The orbits are sepa-

rated from each other by a bony septum. The internal ear is well developed, and the nares open into the cavity of the pharynx, behind the palatine plate.

The sight of most turtles is very keen, and they are generally watchful; though the marine forms are often captured while apparently asleep, their heads resting on some floating piece of timber. They are also not unfrequently rendered partially blind from the stings of the Portuguese man-of-war, *Physalia*, a cœlenterate of which they are very fond. The eyes are capable of being protected by not only the ordinary upper and under lid, but also by a third, like that of birds, a lateral nictitating membrane. Hearing in some forms is acute; the fact that many, if not all, are

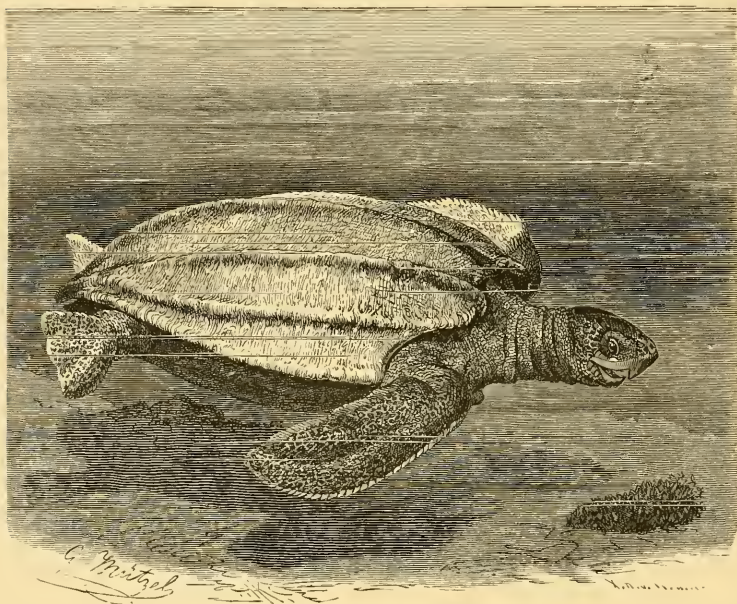


FIG. 256. — *Sphargis coriacea*, leather-back turtle.

musical, argues that their organs of hearing are well developed. The tympanum is at the side of the head, and, like that of the frogs, is unprotected by either valves or cavity. The senses of smell and taste, allied to each other, are but poorly developed.

The circulatory, digestive, and reproductive organs generally resemble those of the lizards proper, though the Crocodilia are anticipated, and the birds to some extent foreshadowed. Respiration is effected by the swallowing of air, the rigid carapax and plastron effectually preventing the expansion of the chest. All turtles are oviparous.

While some of the families of the order of which we are now to treat contain genera which may be enumerated by tens, and species by hundreds, the more embryonic

and introductory family SPHARGIDÆ contains but a single genus, which is represented by a single species.

As will be seen from the illustration, *Sphargis coriacea*, the trunk-back or leathery turtle, is of a depressed top-shape, with the digits not separate, and those of the fore limbs greatly elongated. The back differs from that of all other living turtles in presenting no evidence of its costal origin, and the skin of the exposed portions of the body is unprotected by scales. The animal is of most gigantic size, exceeding that of any other member of the order; specimens weighing over a thousand pounds being not unfrequently captured. Though an animal of the widest distribution, it being found not only through the temperate portions of the Atlantic, but even of the Pacific and Indian oceans and the Mediterranean Sea, its habits are but little known, as it is in no one locality sufficiently abundant to be profitably studied. An interesting account, however, is given by an English officer of a female captured in India.

"She was captured February 1, 1862, near the mouth of the Yé River, on the sandy beach of which she had deposited about a hundred eggs, when she was surprised by a number of Burmese fishermen who had been lying in ambush near the spot (a favorite resort of the common turtle, *Chelonia virgata*), and after a desperate struggle was secured. Her entire length was six feet two and a half inches.

"The strength, aided of course by the enormous weight, of the animal was such that she dragged six men, endeavoring to stop her, down the slope of the beach, almost into the sea, when she was overpowered by increased numbers, lashed to some strong poles, and brought into the village by ten to twelve men at a time.

"The eggs were spherical, of $1\frac{1}{2}$ inches diameter, and were as palatable as those of the river tortoise are nauseous. Besides those the animal had laid in the sand, there must have been upwards of a thousand in her ovary, in all stages of maturity. The flesh was dark and coarse, and very few of the crowds of Burmans assembled at Yé to see the animal would eat any of it."

In 1880 a large leather-back was captured in a mackerel net off Cape Ann. It was brought to the Summer Laboratory of the Boston Society of Natural History at Annisquam, and from some of its flesh a soup was made, which all who partook agreed was as good as that from the green-turtle.

The family PROTOSTEGIDÆ has been established to provide for an enormous sea-turtle, once inhabiting the bays of the western inland seas of geological times, and at present known from fragmentary fossils.

This turtle, described as *Protostega gigas*, is characterized by having the protecting shield not formed by the expansion of the ribs into a bony roof or plastron, but by the development in the skin of large plates, having no sutural connection either with each other or with the underlying ribs. Such fragments as have been found show that the fore limbs must have been elongated and flat, like those of the sea-turtles of to-day, while several other peculiarities, with this, make it quite likely that the animal's affinities are with *Sphargis*, one of the most ancient of existing turtles.

The family CHELONIDÆ includes four genera of marine turtles, all of which are found along the coast of the United States. They resemble each other in having the feet compressed and fin-shaped, and, as well as the neck and head, too massive to be retracted beneath the shell. The carapax is so broad and flat that when the animals are placed upon their backs, they are helpless, and it is never osseously united with the plastron. The head is large and rounded, and covered with bony shields. The animals are strong and powerful, of enormous size, and frequently lead for months at

a time a pelagic life, repairing to the shore only to deposit their eggs, which are buried, often to the number of two hundred or more, in the sand. Sea-turtles are of considerable value as food, though the East Indian species are not as generally used, because of the poisonous qualities supposed to be acquired at certain seasons of the year. Extinct members of the family have been found in the tertiary deposits.

The genus *Thalassochelys* has fifteen vertebral and costal shields, which are thin and not imbricate. The American loggerhead, *T. caouana*, is a carnivorous form, living on fishes, crustaceans, possibly sponges, and especially on the soft parts, which they obtain by nipping off the spire, of the large conches so abundant in the more

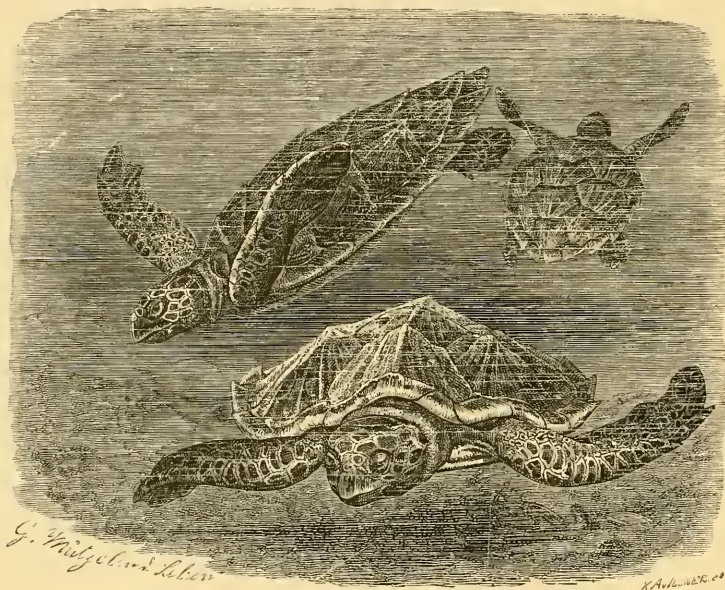


FIG. 257. — *Eretmochelys imbricata*, hawk's-bill turtle, caret.

southern waters. It is found along the Atlantic coast, from Brazil to Massachusetts, and is not infrequently captured about the southern shores of Europe and in the Mediterranean. During the months of April, May, and June, their breeding season, they are to be seen about the low, sandy islands of the southern and gulf states, when they are much less suspicious than usual, allowing boats to approach quite near to them, and are hence captured at this time in large numbers. At night the females approach the shore, and dispose of their eggs, which, as well as those of the green-turtle, are eagerly sought after by fishermen. For food, the flesh of this species is inferior, being rank and tough. Instances of the loggerhead weighing over 450 pounds are rare, much less in weight, it will be seen, than the green-turtle. An Indian Ocean

species, *T. olivacea*, has but a single claw on each foot. Its flesh is only eaten by the Chinese.

Of the genus *Eretmochelys* but two species are known, both of which are found along the coast of the United States; *E. imbricata* from Brazil to the Carolinas, and *E. squamata*, along the Pacific coast. They are at once distinguished from the other sea-turtles, because of their small size, and in that the thirteen vertebral and costal shields are imbricate.

The hawk-bill or caret, *E. imbricata*, is a carnivorous animal, living on the same food as the loggerhead, but of a much more ferocious nature, snapping at whatever may excite its rage, and in captivity using its strong jaws with no other apparent reason than to pick up a quarrel. From an economic standpoint, the animal is of considerable value, because of its so-called 'tortoise-shell,' the horny imbricate plates covering the bony framework, which are in this genus very thick, and of such a nature that by the proper application of heat they cleave away from the underlying bone and can be warped or moulded after being immersed in hot water. It is of good quality only when taken from the older individuals, and varies much in weight. The caret of the Pacific is said to be sometimes roasted alive until the plates start from its back; these are torn off, and the animal is then allowed to escape. This cruel expedient is resorted to because the shell is supposed by the ignorant fishermen to lose much of its brilliancy if the animal has been dead for any length of time. The finest tortoise-shell, however, — that taken on the Celebes, — is removed by the use of boiling water after the animals have been previously killed. The flesh of the hawk-bills is inferior, though their eggs are sweet and palatable.

The genus *Chelonia*, having thirteen large appressed plates on the back, is represented by an Atlantic and a Pacific species.

The common green-turtle, *C. mydas*, is found along the Atlantic coast, from southern Brazil to Cape Hatteras, and is not infrequently seen in the Gulf Stream, and even further north, a few specimens having been taken east of Long Island. This is the most valuable of the turtles for food, and sometimes reaches the enormous weight of eight hundred and fifty pounds. It is a vegetarian, feeding on the roots of *Zostera*, the plant known in New England as eel-grass, though further south it is called turtle-grass. When thus grazing, the roots only being acceptable food, the tops are allowed to rise to the surface, where they indicate to the 'turtler' the animal's whereabouts, who, armed with a strong steel barb attached to a rope, and loosely fitted to the end of a pole, carefully rows up to the unsuspecting animal, with a strong thrust plunges the barb through its shell, withdraws the pole, and grasping the rope, now firmly attached to the turtle's back, lifts the animal to the surface, and, with assistance, turns it into the boat, where it is rendered helpless by being thrown on its back and by having its flippers tied. It is not immediately killed, but is placed in a 'crawl,' or turtle pen, where it is bathed by the tide, to wait with other unfortunates the departure of some vessel for the northern markets. The war of extermination is not waged against the adults alone, nor only in their proper element. Early in summer the females repair to the low, sandy, uninhabited islands of the Gulf of Mexico or the Caribbean Sea. At night, if there seems no ground for suspicion, one crawls some little distance up on the sand, and, finding a satisfactory place, at once begins to dig a hollow, in which are deposited from seventy-five to two hundred spherical eggs of about the bulk of those of a hen. These are carefully covered over, and the animal retreats to the water. The turtler, on going his rounds the following morning, notes the trampled

sand, and, by probing with a slender stick, finds the exact position of the eggs. Experience has taught him that in just fourteen or fifteen days the turtle will again return to this same locality to deposit, in a new hollow, a second, third, fourth, or even a fifth lot of eggs, and, so, stationing himself on watch, he surprises the unsuspecting animal as she leaves the water, by means of a pole turns her on her back, and thus leaves her until means are found for carrying her to the crawl.

If the eggs are not discovered, in about six or eight weeks, incubated by the sun, they hatch, and the young scramble towards the water, on the way to which large numbers are killed by birds, and during the first few weeks of their marine life, their shell being comparatively soft, they are destroyed in large numbers by sharks and other predatory fishes. The flesh of the Pacific form, though at certain seasons of the year unhealthful, is said to rival the Atlantic in flavor. The eggs are in great demand, being of particularly rich flavor and are collected in large numbers by the natives of the East Indies. They are only of about an inch in diameter, and are said to keep fresh for a considerable time.

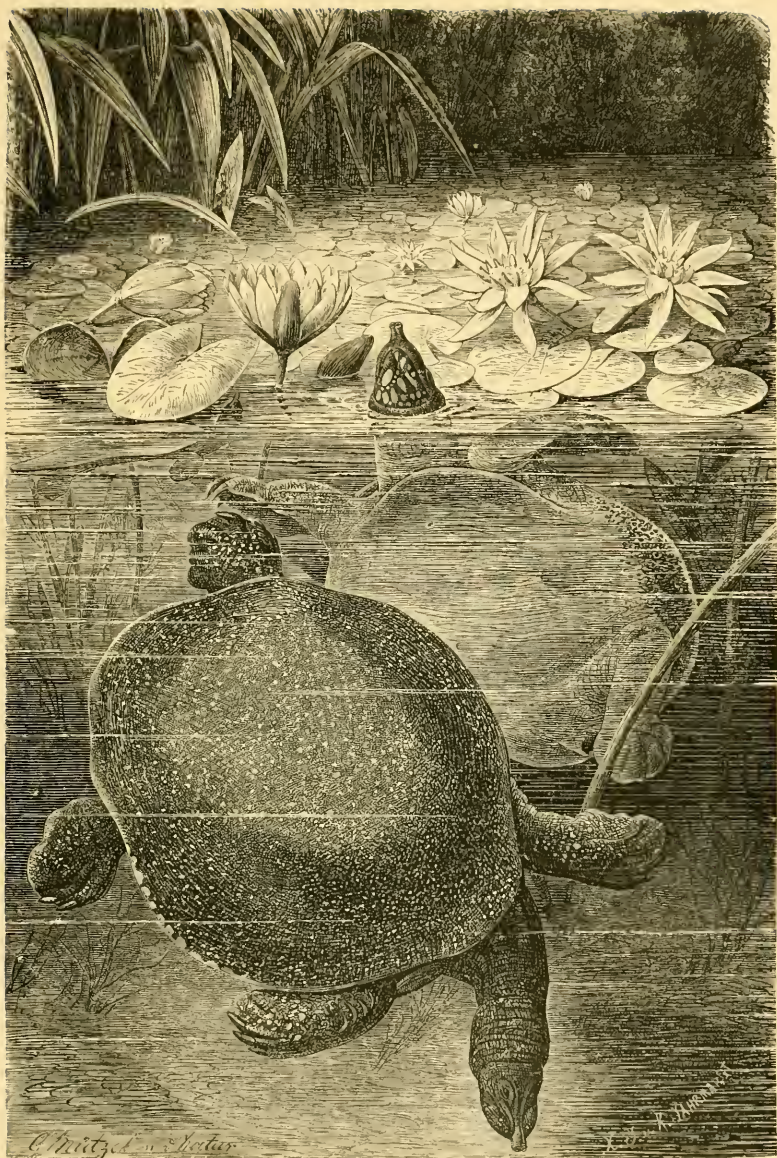
In concluding with the Cheloniidae a singular fact may be mentioned. The logger-head and green-turtles not infrequently interbreed, and the offspring, known to the fishermen as the 'bastard-turtle,' has been described as *Colpochelys kempii*.

The family PROPLEURIDE is represented by the extinct genus *Osteophygis*, the largest species of which are from the cretaceous deposit of New Jersey. The family is interesting in that its representatives have peculiarities of structure which correspond on the one hand with the sea-turtles, and on the other with the fresh-water Trionychidae.

The family TRIONYCHIDE is of particular interest, and is represented by several living as well as fossil forms. The soft-shelled turtles, as the members of this family are called, have the body greatly depressed, sub-circular in outline, and covered with soft skin. The feet are formed for swimming; the toes distinct, strongly webbed, and terminated by three claws. They are carnivorous animals and lie in wait, half buried in the mud of the warm, shallow pond-holes which they inhabit, their long neck and head swaying to and fro in the water with a serpentine motion and occasionally projecting towards the surface, where the elongated nostrils are protruded above, and a fresh supply of air is taken in. In ploughing through the mud they often meet with fresh-water mussels, of which they are particularly fond. They are active swimmers and purely aquatic, leaving the water only when compelled to. The eggs, the shells of which are hard and calcareous, are deposited but a few feet on shore, the young easily finding their native element. On the pond in which they live drying up, retreat is found, in company with eels and silurid fishes in the underlying mud, where they remain until the period of drought is over. In confinement they are active and aggressive, though they feed readily, eating vegetable as well as animal food.

Amyda mutica is the smallest of the American Trionychidae and inhabits the valley of the middle and northern tributaries of the Mississippi as well as the St. Lawrence rivers. It is distinguished from the members of the succeeding genus in having no tubercles on the carapax. A large specimen, measuring twelve inches from the front to the hind margin of the shell, contained in its alimentary tract fragments of larval insects.

Aspidochelys ferox was described as early as 1771 and is popularly known as the soft-shelled turtle. Its habitat is more southern than that of the previous form, being



Aspiderochelys ferax, soft-shelled turtle.

found only in those rivers which empty into the Mexican Gulf. It is said to be in its natural state a most voracious animal, almost constantly remaining in the water, and being a most active swimmer, easily capturing fish and reptiles, the young alligators contributing a large share towards its support. Though the ordinary hiding-place is in some hole of the bank or under some projecting log, the soft-shelled turtle is known to not infrequently leave the water and completely bury its body in the mud, keeping up a communication with the outside world by means of its long neck and head, which is ever and anon thrust out of a small breathing-hole which is left open. They are also, during warm summer days, seen, like other turtles, upon protruding logs or rocks, basking and apparently asleep, though a slight disturbance in their neighborhood will start them into the water. This gregarious habit has been observed by those wishing to capture the animals, and while they are unsuspicious a net or other obstacle is placed in the water round the rock on which they rest, and large numbers are captured as they endeavor to escape. They are of a fierce nature and bite furiously when provoked. The flesh is said to be superior to that of the green-turtle. Though ordinarily inactive on land, in the spring the female often makes her way up steep banks to a suitable locality for the deposition of her eggs, which are numerous, sixty or more being deposited at a time. The shell of a large specimen of this species measured eighteen inches in length.

Amyda spinifer is of the same habitat as *A. mutica*, from which animal it can be at once distinguished, however, in that it has the upper portions of the shell provided with several conical prominences. It has been confounded with the Southern *A. ferox* by many writers, though it differs considerably from that animal, in several important particulars. Allied forms are found in the western hemisphere, of which *Chitra indica* is the largest living representative of the family. Specimens have been known to weigh two hundred and forty pounds. It inhabits the river Ganges as well as several estuaries of the Malayan peninsula, and is eagerly sought by the Chinese for food.

Fragments of extinct members of this genus have been found in the cretaceous deposits of New Jersey, and in the tertiary formations of the west; though anything like complete shells are uncommon. These fragments belong to animals resembling those of to-day, and prove the genus to be of great age; a fact that could also have been arrived at by an examination of the animal's structure, which is of a most embryonic type, lacking those points of specialization characteristic of the higher members of the group.

The EMYDIDÆ includes all the so-called fresh-water turtles of the globe, and is by far the largest family of the order; it being represented by at least sixty species, presenting a wide range of structure, habit, and size. The members are characterized by having the shell more or less depressed, though it may sometimes be convex; the toes distinct and webbed, the feet forward for walking or swimming, the claws usually five in front and four behind, though there may be only four toes on each appendage. The shell is invariably covered with horny shields, and those overlapping the tail are not united along their median edges. From only a casual examination of the variety of points presented by this family, it is apparent that it includes animals of diverse habits; there being forms which are not only aquatic, but those which are nearly as exclusively terrestrial as are some of the land-turtles. Of broad distribution throughout the temperate and tropical regions, in North America alone are six genera. The eggs are oblong, deposited in the sand, as are those of the previous family, and the young are circular in outline.

Preudemys rugosa, the potter or red-bellied terrapin, is an animal of very limited geographical distribution, being found only east of the Appalachian Mountains, and from New Jersey to Virginia. It is, however, quite abundantly found within these limits, and is often captured for market in the Delaware and Susquehanna rivers, though its flesh is not held in great esteem. The length of the shell seldom exceeds eleven inches. The color above is dark slate, with reddish blotches, while below it is of an intense red, ornamented with yellow. The jaws are prominently toothed. *P. concinna* and *mobiliensis* are allied forms, inhabiting the more rocky rivers of the south, but are of limited distribution.

P. hieroglyphica, has been so named from the hieroglyphic-like markings along the margin of the carapax. It sometimes reaches a foot in length, and inhabits the middle, western and gulf states. The yellow-bellied terrapin, *P. scabra*, is of about the same size, though a much less elegant animal, the shell being carinate and deeply serrated posteriorly. It inhabits the warm shallow brooks of fresh water of the southern states, south of the habitat of *P. rugosa*. Specimens are often seen in groups of a dozen or more, collected on some half-submerged log, and, though apparently half asleep in the sun's rays, on the slightest appearance of danger they drop off into the water, the only evidences of their presence being in the carefully protruded snouts these appearing at different points over the surface of the water. Though wary and suspicious, they are, nevertheless, captured in large numbers and sent to market, where they masquerade under the name of 'terrapin.' When in their native element, their diet is chiefly carnivorous, though in confinement they soon accustom themselves to vegetables, of which they seem to become very fond. *P. troostii* is a very abundant form, inhabiting the valley of the Mississippi as far east as Illinois. It was dedicated to Professor Troost, a gentleman who gave no little assistance to Holbrook in the preparation of his work on the American reptiles.

The most interesting species of *Malacoclemmys* is the salt-water terrapin, *M. palustris*, inhabiting the marshes along the Atlantic coast, from Massachusetts to Texas, and even to South America. About Charleston they are very abundant and are captured in large numbers for market, especially is this the case at the breeding season, when the females are full of eggs. Further north they are dug from the salt mud early in their hibernation, and are greatly esteemed, being fat and savory. In the water the terrapin is an active animal, comparatively seldom captured, being always on the lookout and extremely wary. On land it is a good traveler and quite able to escape from any ordinary enemy. In the market it can be distinguished from the other turtles by its short body and the concentric markings of the dorsal plates. The color above is dark brown and pale grayish green. *M. geographicus*, the geographical terrapin, is peculiarly marked and streaked above with narrow reddish lines. It is found in the eastern Mississippi Valley, reaching eastward as far as Pennsylvania and New York.

Chrysemys is characterized by having a deep notch at the anterior portion of the upper jaw, on each side of which the projecting horny sheath forms two teeth. *C. picta*, or the painted-turtle, is perhaps the best known of the American Testudinata. Its geographical distribution is extended, the animal being found from the Gulf of Mexico to the Gulf of St. Lawrence, and inhabiting nearly every pond, pool, or slow stream. While one is riding in the cars, this species as well as *Chelopus guttatus* are seen by myriads, the two clans seldom mixing, crowded together on some projecting rock or half submerged log, their necks stretched out to the utmost, and to all ap-

pearances enjoying the sun to its full benefit. They are, comparatively speaking, active climbers, and may not infrequently be seen perched in situations which would seem to be unattainable by creatures presenting so few adaptations other than natatory. They are timid, however, and quickly retire to the water on being disturbed. Their voracity often leads to an untimely death at the hands of the indignant angler, whom they bother to no little extent by seizing his finely prepared tackle. The ordinary food consists of the succulent stems of various water plants, as well as such unfortunate tadpoles, earth-worms, or larval insects as may fall in its way. Though it begins hibernation early in the fall, but a few warm days in spring are necessary to awake it from its lethargy, when its shrill piping note is heard, often at night making the low-lands ring. The eggs are deposited at evening in a shallow hollow scraped out of the soft sand of some neighboring bank, and carefully covered, where, unless found by some marauding skunk, they are hatched by the sun's heat. This is our most beautiful turtle, its bright colors distinguishing it from all other members of the order. The general color above is dark brown, a yellow line dividing the vertebral plates, which are further

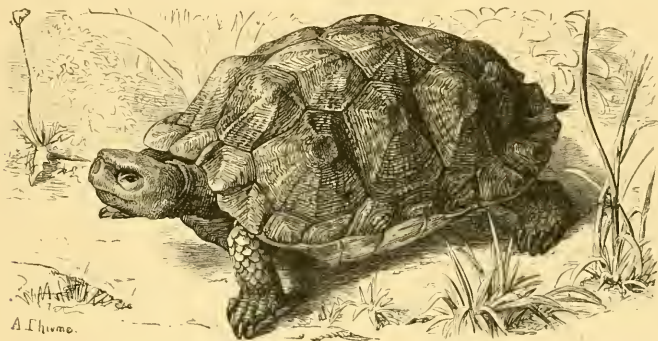


FIG. 258. — *Chelopus insculptus*, wood-tortoise.

bordered, as well as the costals, by broader bands of the same shade. The marginal plates are concentrically marked with deep red, a color which fades away soon after the animal dies. Below, the sternum usually presents an unspotted, uniform bright yellow color, though occasionally a beautiful purple obtains. In the western and more central regions the Oregon turtle, *C. oregonensis*, takes the place of the present species.

Chelopus guttatus, the speckled-turtle, is a familiar form north and east of the Ohio. The small yellow dots covering the black back are very characteristic, and it is a strange fact that they increase in number with age, the young having but a single one on each scale. Its habits are much like those of the painted-turtle. *C. muelenbergii* is limited in its distribution to the valley of the Delaware, and is uncommon. *C. insculptus* has a general distribution coinciding with that of *C. guttatus*, though it is much more local. This animal has received the popular names of horse, sculptured, river, and wood-tortoise, the first possibly being given because of the bright bay color of the animal's body and limb. In certain localities it is an abundant animal, and, unlike other members of the family, is not confined to the water, where it is greatly annoyed by a leech, dozens of which are often found attached to it, but is often met

with some distance from water and often in the dry uplands, where it crawls leisurely along, stopping now and then to feed on the leaves of some favorite plant. On being surprised it quickly withdraws itself into its shell, and might be passed unnoticed were it not that it hisses so loudly. On examination the shell is seen to be composed of very distinct, concentrically sculptured and brown-rayed plates; a prominent ridge being formed along the back by successive longitudinal prominences. Below, the yellow plastron is divided into twelve portions, each bearing on its posterior and outer corner a large black blotch, around which is a series of suture-like grooves parallel with the general contour of the plate. *C. marmoratus* inhabits the Pacific regions.

Emys is represented in North America by a single species inhabiting the more

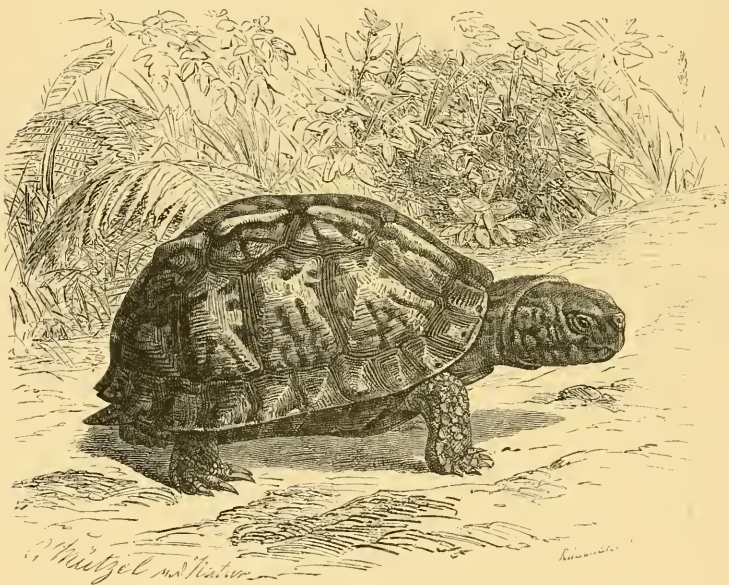


FIG. 259. — *Cistudo carolina*, box-tortoise.

eastern districts from Wisconsin, and known as *E. maculagris* or Blanding's box-tortoise, an interesting form, as it connects the more ordinary members of the family—those having the plastron immovably united to the carapax—with *Cistudo*, where it is not only free, but movable at both ends in a vertical plane. The carapax of this animal is strongly convex and rounded, much resembling that of the box-tortoise, though it is above of a dark green color spotted with yellow. Below, the plastron is provided with a longitudinal ligamentous fulcrum connecting it with the carapax, and a single transverse hinge, between the six anterior and six posterior plates, which allows, aided by the fulcrum, after the extremities have been drawn beneath the carapax, of all being protected by the closing of the thus formed lids. Blanding's tortoise exceeds the com-

mon box-tortoise in size. Its young are jet black, and, though the parents are elongate, nearly circular in outline. *E. lataria* is the European representative.

The genus *Cistudo* includes the common box-tortoise, inhabiting the United States east of the Mississippi, and presenting more variety of form and coloration than any other member of the family. It is in most localities quite abundant, and is found in pastures and uplands, seeking its food of 'toad-stools' and 'mushrooms,' and may at once be recognized, in that it is able, by means of the two lids of the plastron, to completely enclose itself in its shell, and in having its upper jaw unprovided with the anterior notch so characteristic of the previous form. Though the shell seldom

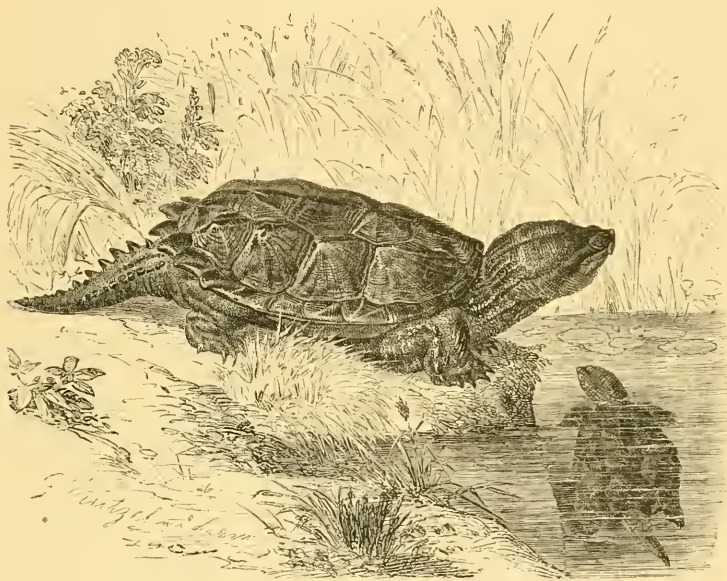


FIG. 260. — *Chelydra serpentina*, snapping-turtle.

measures over seven inches in length, the animals live to a most remarkable age, seemingly until put to some violent death. A venerable box-turtle was recently seen which bore dates of the latter part of the last century, as well as successive dates of the present. There have since been five generations in the family of the one who first carved his name on the plastron of this respected resident. Unlike our other turtles, this species, *C. carolina*, has a particular dislike for the water, and soon dies if placed in it. The toes often vary in number with different individuals, those having only three on the hind feet being not uncommon in the more western and southern habitat. *C. ornata*, a form which always has the vertebral scales keeled, and is depressed and rounded, inhabits the valley of the upper Mississippi and the country lying south.

The genus is well represented in Europe by the yellow-tortoise, *C. europæa*, inhabiting all the warmer countries, where they are to a limited extent used for food.

The family CHELYDRIDE is represented in the New World, from Canada to Ecuador, by the common snapping-turtle, *Chelydra serpentina*, an animal adapted for active defence. The shield being too small for the complete retraction of the extremities, the enemy is boldly faced and attacked, the reptile's long reach and strong jaws being sufficient to defeat the attacks of any ordinary foe. The elongated tail of this animal is very characteristic, and from its appearance has not only given rise to the popular name, 'alligator-turtle,' but, appended to the small, comparatively thin shell, gives an elongated appearance to the body, resulting in the specific name, *serpentina*. In its habits, both in the water and on land, the snapping-turtle is bold and fierce, and will often suffer itself to be lifted from the ground by the object which it has grasped rather than let go its hold. As it elevates itself for the attack, with half-open mouth and sullen eyes, there is something fierce and defiant in its attitude, though it is so slow and awkward in recovering itself after missing its point of attack that it presents a most ludicrous picture. Members of the species are remarkably strong—the elder Agassiz states that he has observed one to bite off a piece of plank more than an inch thick—and they grow to a considerable size, being our largest inland representative of the order, specimens not infrequently exceeding the length of three feet. In the northern states, from the tenth to the twentieth of June, the female, at early morning, leaves the water and crawls to a sand bank, digs a small cavity, not with its tail (a popular belief), but with its hind leg, into which the small spherical eggs are deposited to the number of twenty-five or thirty, when the sand is drawn over them, the surface smoothed down, and the animal is soon back in the water, the entire operation not lasting over twenty minutes. This mode of oviposition is different from that of our other turtles. While the snapper is satisfied with nothing but sand, the painted and speckled-tortoises put up with any soil in which they can scrape, not a cavity, but a hollow, and at evening rather than early morning. An allied form, *Macrochelys laeertina*, inhabits the tributaries of the Mexican Gulf, extending northward in the Mississippi as far as Missouri. Its diet, like that of the previous species, consists of the smaller animals, which it captures by a quick lunge, seizing them in its powerful jaws.

The family CINOSTERNIDE includes the smaller fresh-water turtles, the largest of which is smaller than the smallest of the Chelydride. On leaving the water they seldom attempt any long journey, but bask in the sun in such a situation that on the slightest sign of danger they can drop into their native element, though, if so unfortunate as to be captured, they, though ridiculously small, endeavor to defend themselves by freely using their jaws. They are carnivorous, and possibly, to some extent, herbivorous. The eggs are few in number, and, unlike other turtles, excepting the Trionychide, are covered with a strong glazed shell, which, though thick, is very brittle.

Aromochelys odorata is a small turtle found in pools, often covered with a thick growth of green algae, inhabiting the more eastern portions of the United States, and known as the musk-turtle, besides other savory names, of which the scientific is perhaps the most expressive. In length the shell of this animal seldom reaches six inches, while the plastron is cruciform, resembling to some extent that of *Chelydra serpentina*. The convex brown carapax, generally covered with algae, the pointed head and strong odor, renders this animal not easily confounded with our other turtles.



Testudo elephantopus, Galapagos tortoise.

Cinosternum has four representatives in the United States, of which *C. pennsylvanicum*, the mud-tortoise, very generally distributed over the southeastern two thirds of the United States, is of small size and resembles the previous species, though the plastron is divided in to transverse portions, the anterior and posterior of which are capable of more or less vertical motion, enabling the retracted head and limbs to be more thoroughly protected. It is an animal which readily takes the bait, and is of no little annoyance to the angler. Other species are found in the southwestern parts of the Union.

TESTUDINIDÆ embraces those turtles which have the shell very convex and whose feet are developed for a terrestrial life. The toes are distinct, the feet club-shaped, and the caudal plates united. The North American representatives are two in number,

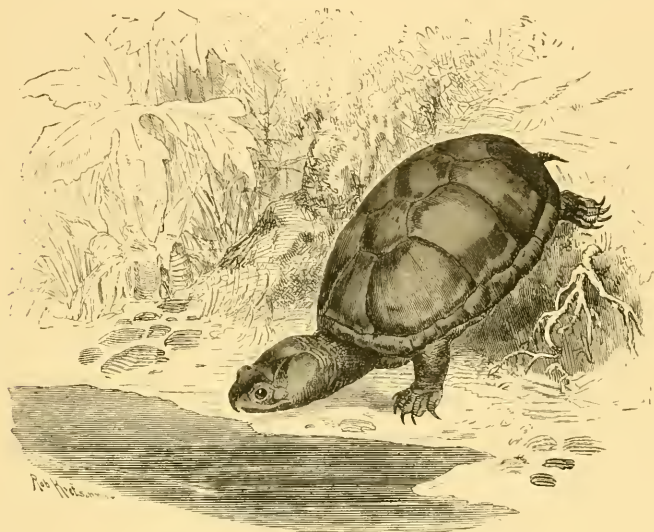


FIG. 261. — *Cinosternum pennsylvanicum*, mud-turtle.

Testudo carolina and *T. agassizii*, the latter of the southern Pacific and the region around Sonora. The former, the common 'gopher,' the shell of which is often fifteen inches in length, is a strong animal, and is more or less gregarious, troops being often met with in the pine-barren country. Though in confinement they eat at all times of the day, they are said to be, naturally, of nocturnal habits, making midnight raids on the farmers' sweet potatoes, bulbous plants, and melons, and retiring to their burrows during the warmer portions of the day, or on the approach of showers, where they also hibernate. These homes are inhabited by a single pair, and are dug to a length of four feet, the interior being large and spacious, while the mouth is only the size of the larger animal. The negroes, in capturing the 'gophers,' sink a deep pit in front of the hole, and the unfortunate animals, on sauntering out, as they are obliged to daily, drop in, and are unable to escape. The females are considerably larger than

the males, and are very strong, the weight of two hundred pounds having been said to be carried on the back of one. The eggs, which are about the size of a pigeon's, and five in number, are much esteemed for food. They are deposited in a hollow near the mouth of the burrow. The South American *T. tabulata*, has been confounded with this animal, though it is now proved to be a distinct species.

The only European representative of the genus is the common land-tortoise, *T. graeca*, commonly made a pet of in gardens, though its true home is along the southern countries bordering on the Mediterranean, where it is captured for its flesh, and often put on sale in the markets. They are animal as well as vegetable feeders, and are extremely fond of the leaves of lettuce, often using their feet to assist them in divid-

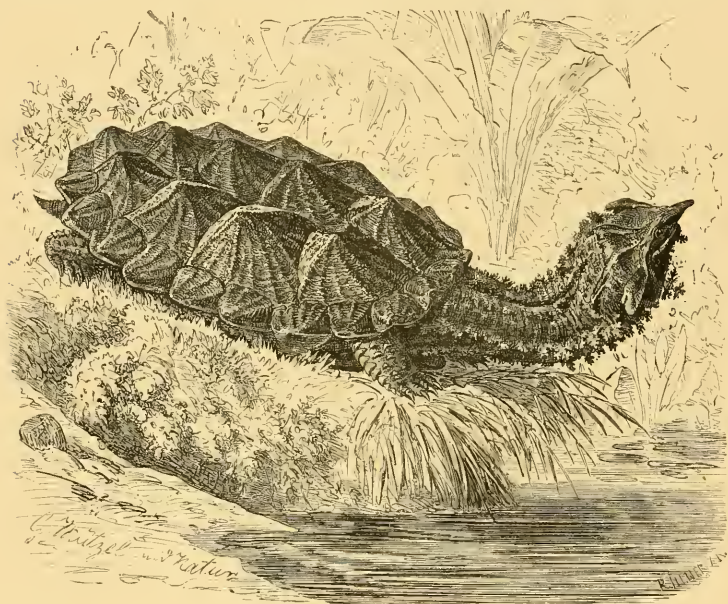


FIG. 262. — *Chelys matanata*, bearded-turtle.

ing the larger leaves. In confinement they drink milk, and eat almost anything that may be given them of a vegetable nature. A strong liking for artificial heat has been evinced.

The land-turtle of the French markets is captured along the coast of Morocco, and in the neighborhood of Algiers, from which places they are shipped. It considerably exceeds the Greek-turtle in size.

The largest representative of the family is the so-called Indian-tortoise, an animal inhabiting the Galapagos Islands, and, though originally described as *T. elephantopus*, the individuals from the several islands are now known to present variations of specific value. Closely allied forms are found in Madagascar.

In a few cretaceous turtles found in the New Jersey green-sand, as well as in several deposits of the same age in the West, and allied to the Testudinidae, there are presented peculiarities of structure which are so exceptional that they have been united in a family by themselves. They are of peculiar interest to the paleontologist, being generalized forms of position intermediate between the Emydidae and Hydraspididae.

To the gigantic river-tortoise, *Podocnemys expansa*, of the Amazon has been given a family value. It is of an enormous size, and is a load for the strongest native, the shell, when full grown, measuring nearly three feet in length. In the upper portions of the Amazon every household has a pond or corral, in which the animals are confined

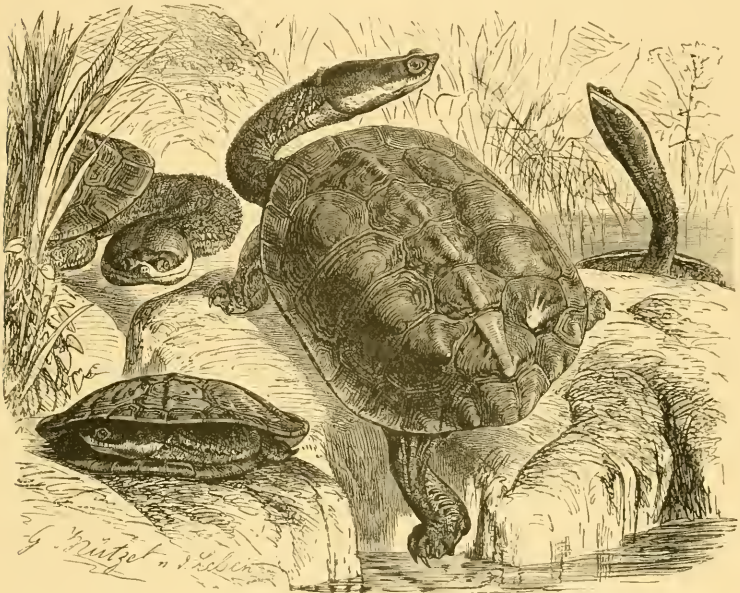


FIG. 263. — *Hydraspis maximiliani*.

during the time of dearth, the wet months. Though the rich people hire servants to capture the animals when the water is low, the poorer classes are obliged to collect them themselves, as markets are unknown. Their abundance varies with the height of the river, in dry seasons the largest numbers being captured. The flesh is very tender, palatable, and wholesome, though one soon tires of it as a regular diet. The eggs are eagerly sought after by the natives, and, that all may have equal advantages, the excursions to the sandy islands are made in a body, all setting to work at a given signal.

In the family CHELYDIDE the elongated neck cannot be withdrawn into the body, as in the ordinary forms, but protection is obtained by bending it round against the

sides of the body and hiding it, as it were, under the eaves of the shell. *Chelys matamoras*, the remarkable fimbriated or bearded-turtle, belongs to this family. This is one of the most peculiar creations of nature, in oddity being exceeded by none. It inhabits the warm fresh-water pools of the tropical portions of South America, and has been, until of late years, quite abundantly found, though, from the unceasing draft made upon it for food, it is now quite uncommon. It is said to be a carnivorous animal, lying in wait, concealed by the rushes of some quiet body of water, for an unsuspecting fish or reptile, or possibly a brood of young ducks, which it captures by a quick extension of its neck. It grows to a considerable size, sometimes reaching the length of three feet. As is shown in the engraving, the snout is greatly prolonged, and the sides of the head and ridges of the neck are provided with peculiar prolongations of the skin, the true office of which is not known. An allied form, *Hydraspis macmillanii*, also inhabiting Brazil, has been given a family value by some naturalists. The figure illustrating this animal shows the peculiar manner in which the head and elongated neck is protected by being applied to the side of the body rather than being withdrawn into the carapax.

The family PELOMEDUSIDÆ includes the single genus *Pelomedusa*, which is characterized by having but two series of phalanges instead of the usual number, three. *P. subrufa* and other species inhabit South Africa.

The highest family of the order, STERNOTHERIDÆ, is based on the peculiar structure of the anterior divisions of the plastron, which are separated transversely, giving the animals ten plates instead of the usual number, eight. This peculiarity is similar to that presented by the genus *Pleurodira*.

ORDER V.—RHYNCOCEPHALIA.

The fifth order of reptiles includes a small number of animals resembling in general outline some of the lizards, though presenting several internal characteristics, as the possession of bi-concave vertebrae and immovable quadrate bones, which are at variance with the forms already treated and are of ordinal value. But a single representative, the *Hatteria* or *Sphenodon* of New Zealand, is still living, though the paleontologist has brought to light the bones of a few pre-existing forms.

The *Hatteria* is one of those isolated animals which, from the peculiarity of its structure, is of interest to the anatomist; as throwing light on the more obscure points in the structure of fossil relatives, and, to the systematic zoologist, fills, as a single specimen, the place of species, genus, family, and order. The general appearance is iguana-like. The tail is compressed and crested, and, like many lizards, being of a brittle nature, is often found reproduced, but without vertebral segmentation. The general color is, above, dull olive-green spotted with yellow, and below, whitish. Besides the peculiar fish-like vertebrae and rigid quadrate bones, some of the ribs are provided medially with uncinate processes, resembling those of crocodiles, if not more strongly those of birds. Third and intermediate portions, like those found in the monotremes and sloths, unite the dorsal with the sternal costae. Teeth occur not only on the jaws, but also on the palatine bones, where they are arranged in a regular series, parallel with those of the maxillaries. The total length seldom exceeds twenty inches. At one time these animals were to be found in abundance along the rocky shores and small islands of the New Zealand coast, where they lived in the crevices of the rocks, or in small burrows of their own construction. Of late, however, being

used as an article of food by the natives, and suffering from the introduction of hogs, they have become uncommon, and will soon be numbered with the animals which once existed but are now extinct.

Of the fossil members of this order, the *Proterosaurus* is of particular interest, as it was the first known fossil reptile, being described as early as 1710 from fragments obtained in the permian beds of Thuringia. A study of the bones of the head, neck, and limbs shows it to have been an aquatic animal of considerable size, capable of seizing and retaining the active fishes which sported in the waters that deposited the old Thuringian copper-slates. *Rhynchosaurus*, from the trias of England, is of interest in that the jaws, like those of turtles, are unprovided with teeth, and the premaxillaries present a curved beak, strongly resembling that of birds. The vertebral centra are, however, like those of *Hatteria*, biconcave. *Hyperodapedon*, also triassic, is an allied form.

ORDER VI.—ICHTHYOPTERYGIA.

The members of this order are all extinct, and are only known from their fossil remains, which have been found in the tertiary deposits of the Old World. Though true reptiles in structure, the *Ichthyosaurs* resembled in general outline, and probably also in habits, the cetaceous mammals of to-day. The broad head, short neck, thick body and short vertebrae resemble these portions of the whales, a general resemblance carried still further by the flipper-like limbs and elongate, probably fin-bearing, tail which performed the office of a propeller. Some of these saurians were colossal in size, reaching a length of forty feet, though many were smaller and resembled the dolphins, being about six feet or even less in length. That the animals were reptiles is at once seen, however, on an examination of the brain cavity, which is of most diminutive size when compared with that of sea-mammals, and is not protected by a solid cranium, the bones of the head being more or less imperfectly united together. The vertebral centra, moreover, were biconcave, and the orbits, which were enormous, sometimes fifteen inches in diameter, were protected by a circular series of triangular plates which may have assisted in adjusting the focus of the eyes, or may have been in their nature merely protective. A study of the jaws, as well as of the half-digested contents of the alimentary tract, proves the *Ichthyosaurus* to have been a predatory animal, inhabiting the open sea as well as the shores, and feeding on fish and other marine animals. Though awkward in its movements, it not infrequently quitted the water and crawled out on some exposed sand-bar to rest or to bask in the sun. *I. communis* is the most common form.

The *Sauranodon*, found in the Jurassic deposits of the west, resembled the *Ichthyosaurus* very closely, though it differed in being destitute of teeth. It is given by some an ordinal, while others consider it of only family, value.

ORDER VII.—THEROMORPHA.

This order includes several extinct reptiles, fragments of which are found chiefly in the Permian and triassic fresh-water deposits of South Africa. The teeth are either wanting or are represented by a pair of maxillary teeth. The vertebrae are biconcave, and the ambulatory limbs are supported by a solid pelvis and firm shoulder-girdle. It was from this order that the mammals are by some supposed to have branched off,

the scapular and pelvic arches, as well as several bones of the limbs, being remarkably like those portions in the *Monotrema*, especially *Echidna*. From a comparative study of the *Pelicosauria*, the fact has been demonstrated that the first terrestrial Vertebrata possessed a notochord. The *Dicynodonts* are known from fragments of their skeletons found fossilised in South Africa, and received their name from the Greek, 'two-tusks.' The skull presents characters which are crocodilian, chelonian, lacertilian, and, in the elongate canine teeth, mammalian. The lower jaw was remarkably turtle-like and was probably encased in horn. Several species have been described. The *Oudenodonts* were without teeth or had them inconspicuous. The head was rounded anteriorly, and in general outline strongly resembled that of the turtles. The *Pelicosauria* are represented by two dozen or more species from the permian beds of America; *Clepsydropus*, from Texas and Illinois, is illustrative.

ORDER VIII. — SAUROPTERYGIA.

The European and New Zealand cretaceous beds have yielded by far the greater number of species to this order. Of the few American forms, *Elasmosaurus* is the most interesting. This animal differed from the *Plesiosaurus* in the structure of its



FIG. 264. — Skull of *Dicynodon*.

pectoral girdle, and was of an elongated form, sometimes forty-five feet in length, and could swim rapidly through the water by using its flattened limbs as oars, or by propelling itself, the tail being long and paddle-shaped. The neck and small head resembled in their motions, as they twisted from side to side or plunged beneath the surface these portions of the swan. It has been found, from an examination of the debris occupying what was once the body cavity of these

sea-saurians, that they fed on the more ravenous fish, which they were enabled to grasp and retain by means of their long, sharp teeth.

While the *Elasmosaurs* ploughed the American waters, the *Plesiosaurs* were no less abundant in the eastern hemisphere. The first fossil representative was found in the lias of Lyme Regis, and, from its peculiar lizard-like form, derived its name, 'near to lizard.' The discovery of this genus was considered by Cuvier to be of great importance, as presenting peculiarities of structure the most anomalous. Perhaps the better way to describe the animal is to follow the words of an early naturalist: "To the head of a lizard it united the teeth of a crocodile, a neck of enormous length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale." The openings of the nostrils were far back, in front of the eyes, and may have been used as spout-holes. Of a score or more of species which have been described, *P. dolichodeirus*, which attained a length of twelve feet, is, perhaps, the most commonly found. The neck was of great length, exceeding, by several vertebrae, that of the swan. A study of the ribs shows the animal to have been capable of taking in a large supply of air, and the inference is that it could remain submerged for a considerable period of time. It was, moreover, less adapted for a pelagic life than the *Ichthyosaurus* and probably seldom wandered far from the more shallow waters.

ORDER IX. — CROCODILIA.

This order embraces those aquatic reptiles which have the teeth firmly implanted in the jaws, the body protected by a thick, armored skin, and the four limbs and tail formed for swimming as well as for crawling. While in the previous order the limbs were only represented by paddles, we now come to animals which not only have these appendages freely articulated, but have them ending in separate digits. The skin is thick and heavy, and bears, in its dorsal regions, strong, osseous plates. The jaws proper are the only bones which bear teeth, and these are wedged into alveoli and are conical in outline. The fourth tooth of the mandible often considerably exceeds its fellows in size and fits into an excavation in the upper jaw. It is used as the chief organ of prehension. The structure of the vertebral centra varies in the several sub-orders, though all the existing crocodiles have them concave anteriorly. The structure of the soft parts is the highest presented by living reptiles. The organs of special sense are well developed. The eyes have the pupil vertical, and are protected by two lids, and also by a nictitating membrane. Both nostrils and ears are provided with cuticular valves. The buccal cavity has posteriorly an arrangement which prevents water from passing into the pharynx, when the mouth is held open by the struggling prey. The stomach is remarkably bird-like and passes into a zigzag intestine, to which are attached no cæcal appendages. The intestine decreases in size before entering the cloaca, which gives attachment to the erectile copulatory organ. The heart is highly developed, and, in having a distinct right and left ventricle, effectually prevents the mixture of the venous with the arterial blood. The order is divided into three groups, of which the procœlous, existing crocodiles, and the fossil *Thoracosaurus* will be first treated.

The crocodiles inhabit the warmer portions of America, Asia, Africa, and Australia, and naturally divide themselves into three groups: The gavials, having the cutaneous plates of the top of the head and back continuous, and the canine teeth of the lower jaw fitting into notches in the margin of the upper jaw; the crocodiles proper, having the plates of the head separated from those of the back, but having the canine teeth fit into notches as in the previous group; and the alligators, having the plates of the back like the crocodiles, but having the teeth fit into pits rather than into notches.

The gaval, or nakoo, of India, *Gavialis gangeticus*, has the snout elongated, linear, and swollen at the tip, and the lateral teeth oblique. This animal is one of the largest of the order, and sometimes reaches a length of twenty feet. Old males have the nasal sacs at the tip of the snout considerably enlarged, and are thus enabled to remain below the surface for a considerably longer period than are the females. The development of the snout is of peculiar interest, since the young have it broad and depressed like the alligators. In some of the rivers of India, as a result of a superstition among the ignorant natives, who fear to harm them lest they arouse the anger of the gods, the gavials have become so abundant as to be destructive to human life.

The genus *Tomistoma* has the beak conical, and the teeth erect and received into pits; it is intermediate between *Gavialis* and *Crocodilus*, and is represented by but a single species, *T. schlegelii*, which inhabits the island of Borneo.

Of the crocodiles proper, representatives are found in every continent. *Crocodilus vulgaris*, the Nile crocodile, is found throughout Africa from north to south

and from east to west, and has been known from time immemorial, not only being mentioned in the oldest manuscripts, but appearing on the walls of the ancient Egyptian monuments, which almost antedate history, and is not infrequently found preserved as a mummy. In the upper regions of the Nile these animals actually swarm, and though killed by the hundreds by hunters, and when young by the thousands by their natural enemies, they seem in this locality to hold their own in spite of all persecution. Though rendering the African rivers dangerous to travelers, and destroy-

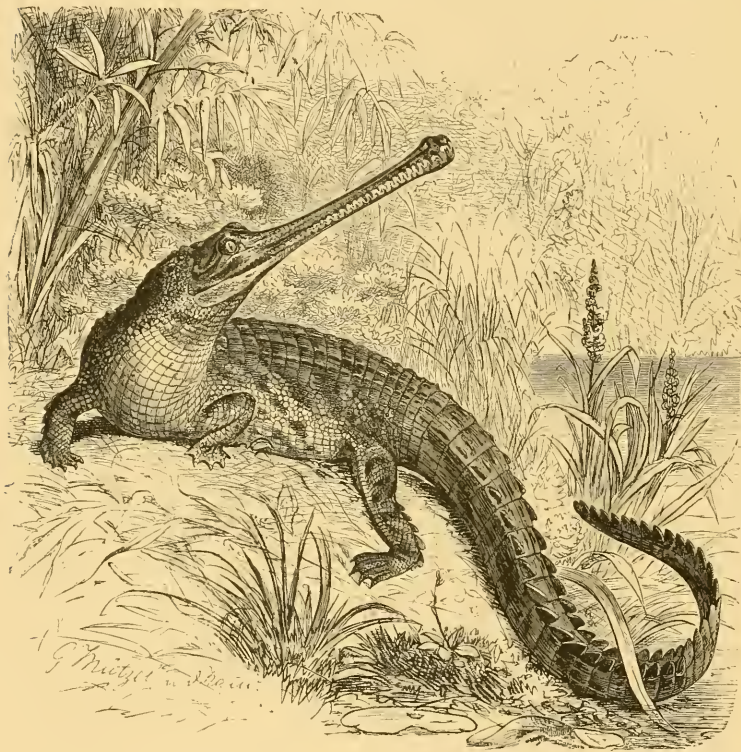


FIG. 265. — *Gavialis gangeticus*, gavial.

ing many of the herdsman's cattle, by seizing them by the snout as they are about to drink, the crocodile, preferring, as it does, the more putrid flesh, as a scavenger is of considerable value, performing in the water what the hyana does on land. Livingstone, in writing of this animal, says it often seizes children as they play on the banks of the rivers, not infrequently rendering them senseless by a blow of the tail. The full-grown natives are, however, seldom attacked, except when they at night attempt to swim across the rivers or enter where the animals are particularly abundant. Ant-

elope are often seen to disappear from view as they seek the water to avoid the hounds, and the dogs are especially palatable to the huge reptile. It is said that the animals acquire a taste for human flesh. In localities where they once caused no great fear, on receiving the dead bodies of criminals, they at length became so ferocious as to be greatly dreaded. The natives kill them by thrusting a barbed spear into their side as they lie unsuspectingly on the bank, or they dig a pit in some frequented path, into which the reptile falls as it flees from the cries of the savages as they "beat the bush."



FIG. 266. — *Crocodilus americanus*, crocodile.

An ancient story, supposed for a long time to be fabulous, is told by Herodotus, the verity of which has been established by the later naturalists. The ancient writer said: "When the crocodile takes his food in the Nile, the inside of its mouth is always covered with a small fly. All birds, with a single exception, flee from the crocodile, but this one, the Nile bird, *Trochylus*, far from avoiding it, flies towards the reptile with the greatest eagerness and renders it a very essential service. Every time the crocodile goes on shore, the Nile bird enters the mouth of the terrible animal and

delivers it from the fly which it finds there; the crocodile shows its recognition of the service and never harms the bird." In the modern classification this bird is the *Charadrius aegypticus*. The eggs of the crocodile are laid in sand, and left to be incubated by the sun's rays, though the female remains in the neighborhood and watches the place of deposit with considerable maternal solicitude. *C. nigra* and *C. cataphractus*, the black and the false-crocodile, are confined to the rivers of the west African coast.

The Indian *C. porosus* is found only in the salt-water estuaries, and has been captured not only around the peninsula of India, but among the islands of the East Indies, as far south as the coast of Australia. From a peculiar ridge over each eye, this form is popularly known as the double-crested crocodile. The young show their fierce natures from the first, and will often allow themselves to be lifted from the water, by retaining their hold on a stick that may have been thrust at them in way of annoyance. During the warmer portions of the year, the double-crested crocodile not infrequently avoids the heat of the sun by hiding in the mud, and remaining thus concealed until the approach of the wet season. The American crocodile, *C. americanus*, was first supposed to be confined to the West Indies and South America, but it is now known to be not infrequently captured in different parts of Central America and occasionally on the peninsula of Florida. It can be at once distinguished from the alligator by its narrow snout, as well as by other characters of the genus already given. Specimens twelve feet in length have been captured. The Orinoco crocodile, *C. intermedia*, has a few times been known to wander north, and may possibly have been met with in Florida. It differs from *C. americanus* in having the snout more slender and the plates of the back more nearly uniform.

Perhaps no reptile is better known to the American than the alligator. Abounding in the low, stagnant pools of the south, its dull body a characteristic feature of the unfrequented morass, and common not only in the cheaper menageries of the north, but as a pet of the amateur zoologist, it is recognized by all and needs no specific description. Though but a few years since seen by the hundreds during a day's journey along the low, muddy shores of the southern and gulf states, it has of late, from the incessant massacre to which it has been subjected by travelers and sportsmen, become less common, and will undoubtedly retire before the advance of the southern settlers. Of its habits, when undisturbed in its native wilds, relatively few have been the observers. It spends the most of the day lying on some low bank or log, where it can receive the genial rays of the sun, though it retires to the water on being disturbed. When thus basking, they are sometimes captured by the more daring hunters, and, with limbs bound, are hurried off to the northern showmen.

The animals may resent being captured so easily, however, and may give the collector no little trouble. That they often voluntarily attack people is doubtful, though there are several instances of their pursuing boats and regarding the inmates with the most suspicious glances. In the water they are very active, and, being strong swimmers, are able to catch the larger fish with but little trouble. For animals, like the musk-rat, swimming across lagoons, they are always on the watch, and many is the disappointed sportsman who has returned home after seeing his hound seized by one of these monsters. Of dog-meat they seem to be particularly fond, and it is said they will congregate on hearing a puppy whine. On seizing its prey the alligator sinks with it to the bottom, and there remains until all struggling has ceased, it is then able with less trouble to tear it in pieces. While thus submerged, the peculiar collar at the

base of the tongue prevents the water from passing into the lungs, and the reptile may even come to the surface and breathe without letting go its hold on its prey. That the reptile uses its tail to sweep animals off the bank into its jaws savors rather of the fancy, though this appendage is often used in self-defence, and is an efficient organ. Not infrequently the alligator can be induced to take the hook, and, when thus captured, will test the strength of the strongest 'shark-tackle.' It is, however, when captured, of a most disagreeable nature; not only does it use its jaws freely, but



FIG. 267. — *Alligator mississippiensis*, alligator,

it emits a most disagreeable odor of musk, which is almost unendurable; it has, however, been used by some as food, Catesby saying: "The Hind-part of the Belly & Tail are eat by the Indians. The Flesh is delicately white, but has so perfumed a Taste of Smell, that I could never relish it with Pleasure." It is also maintained that the negroes, during the colder months, often dig it from the mud in which it is hibernating, and use its flesh. In the stomach are often found the most unexpected articles: stones, bottles, boots, and in one case a camp-stove performed its share of the grinding operation.

In the breeding season, the spring and early summer, the reptiles are very noisy and bellow with thunder-like power. The eggs are deposited in some natural sandy hillock, or in a mound of the reptile's own construction, the young, on hatching, at once directing their course to the water. The eggs are often taken from the nests, however, by tourists, and illegally mailed to northern friends, when they hatch in a climate unsuited to their wants and usually die, though a few have been known to take food and prosper. Adults seldom reach the length of twelve feet. The name given by science is *Alligator mississippiensis*, the animal being found in that river as far north, though rarely, as the Ohio.

The Orinoco cayman, *Jacare nigra*, was the animal with which Waterton had the struggle so geographically described in his "Wanderings." It seems that the naturalist desired a specimen for dissection, and hence one mutilated as little as possible. One of the reptiles was first caught by a cleverly devised hook, and, when drawn on the bank, was mounted by Waterton, as he would mount an English hunter, the reptile's fore feet and legs serving as reins. It is needless to say that it was only by the exercise of considerable skill that the naturalist kept his seat, though he finally succeeded in exhausting the furious reptile. An old hunter and fisherman in southern Louisiana assured me that in a similar manner he had captured alligators for showmen.

Closely allied to the now existing crocodiles was the genus *Thoracosaurus*, inhabiting, in cretaceous times, the shores of New Jersey, as well as the coast of France, and resembling to no little extent the Indian gavial. *T. neocassariensis*, once inhabiting the more eastern portions of our continent, was one of the largest species. The *Teleosaurus*, from earlier deposits, had the jaws greatly elongated, considerably exceeding, in proportional length, those of the gavial of to-day, and armed with long sharp teeth, which enabled them to capture and retain fishes, the only large vertebrates inhabiting the Jurassic seas suitable for food. *Goniopholis crassidens* resembled the *Teleosauri* in having biconcave vertebrae, though its teeth resembled those of the existing crocodiles.

The BELODONTIDÆ, though at first considered otherwise, now hold an important position in the present order. *Belodon lepturus*, the largest of the genus, reached a length of ten feet, and was strong and stout. It lived on the American shores during the triassic period, and was, judging from the posterior position of its nostrils, and probably webbed feet, an aquatic feeder, searching with its elongated snout below the surface for such unfortunate animals as might come within its reach, while respiration was still maintained, as a result of the nostrils being placed almost as far back as the eyes. This genus includes the earliest known representatives of the order. Remains are found in the European as well as in American deposits.

ORDER X.—DINOSAURIA.

In this extinct order appears a series of reptiles, some of most gigantic size, though many are small, which are of particular interest to the systematic zoologist, as many forms, on examination, are seen to possess peculiarities of structure which point towards the lower birds, while others have many points of structure in common with the mammals. The avian peculiarities are not merely superficial, the pelvis and hind limb is remarkably bird-like, and is often of a development which justifies naturalists in considering the reptiles to have been biped, a supposition confirmed by the three-toed tracks of the Connecticut valley. We have consequently in the Reptilia a

series of forms, from those which walked about on all fours to those which stood erect, an instance of evolution paralleled in Mammalia.

The first representatives to receive treatment will be those which had the proximal tarsal bones separate from each other and movably articulated to the terminal faces of the tibia and fibula. *Hadrosaurus* had the teeth in several rows, and so juxtaposed as to give a pavement-like appearance to the armature of the jaw. The members of this genus were of gigantic size, being twenty-eight feet in length, the thigh-bone alone having been forty inches long, though the humerus was only about one half this length. The animals wandered through the old American forests and used their small fore limbs to grasp the branches of trees and direct them to the mouth. In water as well as on land they were active.

Closely allied to the previous reptiles, though having the teeth in a single row, was the *Iguanodon* of the European Jurassic, an animal presenting many points of structure in common with the iguana of to-day. Especially iguana-like were the peculiar teeth.

Though in the several museums of Europe there are many fossil representatives of this genus, the skeleton of *I. bernissartensis*, lately found in Belgium, and now in the possession of the Brussels museum, is by far the most perfect, there being but a few fragments missing. The animal walked on its hind limbs, as do the birds, and left in the Wealden strata its three-toed tracks. The fore limbs, as will be seen from the figure, were extremely short, and, besides being used in gathering food, were probably organs of defence, the thumb be-



FIG. 268. — *Iguanodon bernissartensis*, as restored by Dollo.

ing covered with a strong, conical spine, which could have pierced through the body-walls of any animal which might unwittingly lead an attack. When standing up, as it did while feeding, the *Iguanodon* had a stature of fourteen feet, though when stretched out in the water, its broad tail acting as a propeller, it probably was twenty-eight feet in length. *Scelidosaurus* differed from the *Iguanodon* in having four digits on its hind feet, though its teeth were in a single row. Specimens are very uncommon.

In 1878 what was then the largest known land animal was described by Professor Cope as the *Camarasaurus supremus*, a reptile having the fore and hind limbs well developed, the femur alone being six feet in height, and the animal having a total length—including the strong and elongated tail—of about eighty feet. One of the dorsal vertebrae measured over three feet in width, and equalled in size those of the right whale. Such a huge reptile wandered about on the shores, or in the shallow water, where it could easily reach to the tops of the larger shrubs, or, by resting on its haunches, it might browse on the tops of trees. It held its own, as a fossil, without a rival, for only a short time, for soon, from the same deposit, the early cretaceous of Dakota, appeared the bones of an allied animal, but differing in having the vertebral centra strongly biconcave, or amphicelous, a peculiarity which gave origin to the

generic portion of the scientific name, *Amphicelias alatus*. The femur of this animal, though exceeding in length that of the *Camarasaurus*, was much more slender and probably supported a less bulky animal, though one that probably had a greater height. It is estimated that *A. alatus* could reach to the tops of trees thirty feet high. But huge saurians did not stop with the discovery of this species, for soon there was brought to light the fragments of an animal, one of whose dorsal vertebrae measured six feet from the base of centrum to tip of spine, and, if of similar proportions to its congener, its femur must have measured twelve feet, and the whole animal may have exceeded the length of one hundred feet. This species has been named *A. fragillimus*, and possibly walked along the rocky shores, submerged in the water, and feeding on algae or other vegetable matter.

The figure illustrating the skeleton of *Brontosaurus* was made from a single individual of about fifty feet in length, and beautifully illustrates the peculiarities of structure presented by members of this group. The head, it will be seen, does not exceed in size some of the bones of the neck, and the brain cavity is of the smallest dimensions, indicating an animal of stupid habits. Such a reptile may have splashed round in the water in search of marine vegetable growths, each time it placed one of

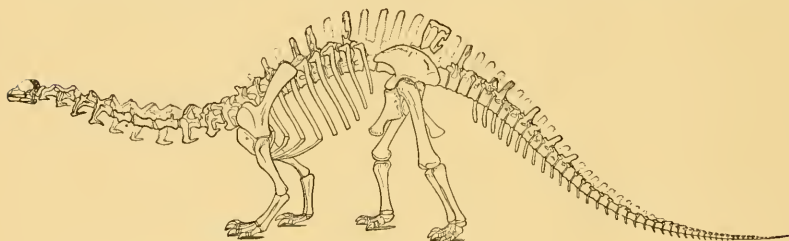


FIG. 269. — *Brontosaurus*.

its feet down making a depression a yard square and of considerable depth, as an animal was supported which weighed twenty tons or more, a weight so great that the reptile was not infrequently mired. In its habits it was slow, and probably intimidated what few enemies it might have had by mere size alone, as there have been found no offensive organs nor defensive armor. When walking on shore it might occasionally have elevated itself on its haunches, and, propped up by its tail, reached into the tops of the trees and browsed on the leaves and small branches. In this upright position, however, it is not likely that the animal could progress for any great distance.

We now come to the group of Dinosaurian reptiles which had the tarsal bones united with the tibia and at an angle, effectually preventing the foot from being extended in a line with the leg, a peculiarity of structure presented also by the young chick. The most interesting genus is *Lalaps*, some of the representatives of which stood eighteen feet in height and were carnivorous animals of the most rapacious habits. They undoubtedly kept within proper limits animals which might otherwise have unduly increased in numbers. The structure of the bones of the hind limb show *Lalaps* to have been a plantigrade biped, while the massive tail gives reason for believing that, when at rest, a position was taken not unlike that maintained by the kangaroo. The jaws were of considerable size and armed with sharp lance-like teeth,

which could probably tear through the tough hide of even the *Hadrosaurus*. While hunting, the *Laelaps* probably wandered around the lowlands, or swam along the shore, until it arrived within twenty-five or thirty feet of its victim, when, with a spring, it cleared the distance, crushing its prey by the weight of its fall, and tearing it to pieces by means of its stout claws and sharp teeth. The crocodiles must have regarded this animal as their greatest enemy, excepting the sharks, while the smaller Dinosaurs probably held it in the same esteem as do to-day the jackals the lion, an animal which leaves much that to them is useful.

ORDER XI. — ORNITHOSAURIA.

We have now reached the highest order of reptiles, the members of which, all now extinct, resembled the birds most, of living animals. The fore and hind limbs were specialized for an aerial life; the beak, though often toothed, was, in many forms, encased in horn; the neck was long and the skull, firm and rounded, with large orbits, strongly resembled that of the birds. Though the pelvis and hind limbs were like those of lizards, the shoulder-girdle with its keeled sternum and wing-supporting bones were remarkably avian. In the vital organization, also, a remarkable approach to the birds was made. The optic lobes were pressed below the cerebrum, and the circulatory system is believed to have been of warm blood, a supposition strengthened by the fact that the bones were provided with air-sacs, to which pneumatic ducts lead from the bronchial tubes, a respiratory system characteristic of only the warm-blooded birds. Feathers, however, nor any other means of protection, have not been found with the fossils.

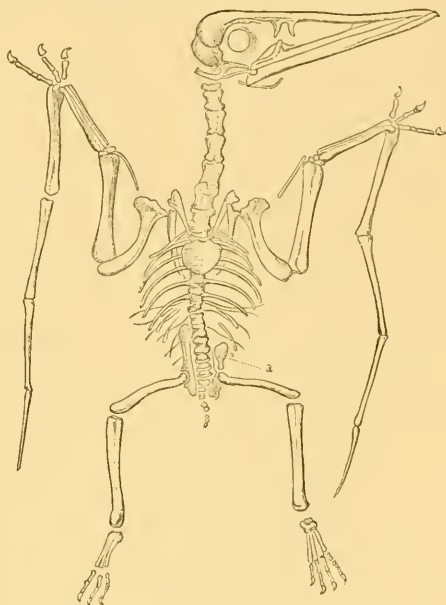


FIG. 270. — Pterodactyl.

The wing consisted of a thin flap of skin, resembling that of the bats, and supported by an elongated ulnar finger. The several members of the order were of varying dimensions, ranging from the size of a sparrow to that of the condor. They were contemporaneous with the Dinosaurs, and formed a peculiar feature of the mesozoic landscape, as they flapped their wings on their journeys through the air, or as they perched themselves, comorant-like, along the shore, in company with the loon-like *Hesperornis*.

The Pterodactyls had the jaws provided with teeth, planted some little distance from each other, and long and slender, which were probably of use in securing fish and smaller reptiles. The tail was short and insignificant, there being a regular decrease in the size of the vertebræ from the neck posteriorly. The centra were, like those of existing crocodiles, most lizards, and all ophidians, concave anteriorly and convex posteriorly. Though good flyers, the pterodactyls were able to make but poor progress on land, and probably crawled along, when obliged to, as do the bats of to-day. When resting, they probably suspended themselves to the cliffs, or to the branches of trees, the fingers seeming to indicate this habit. *Pterodactylus crassirostris* inhabited the lowlands of Germany, and was about a foot in length. Many other species are known from the European deposits. America can boast of but few species, but such as we have are of the largest size. *P. umbrosus*, from the Kansas chalk, had an alar extent of nearly twenty-five feet, while *P. occidentalis* measured eighteen. The *Pteranodon*s differed from the pterodactyls in having the jaws destitute of teeth. They were, however, probably armed with horn.

Rhamphorhynchus is a genus of flying reptiles which inhabited Europe during the Jurassic period. The jaws were provided with long, sharp teeth, the eyes were large and well developed, and the flying membrane was supported, as in the pterodactyl, by the long ulnar fingers, and was of such a size as to easily support the body. The most peculiar feature, however, was the elongated tail, which equalled one of the wings in length. *R. phyllurus* carried at the end of this appendage a terminal, fan-like rudder, which was of use in directing the reptile's flight. Almost perfect remains have been found in the lithographic slate of Germany.

The European *Dimorphodon* had teeth of two kinds; those of the anterior portion of the jaw being large and long, while behind these was a series smaller and more compressed. The skull of *D. macronyx* was about eight inches long, and the wings expanded four feet. It is the oldest known form of the order.

The long series of cold-blooded vertebrates has been reviewed. Next come those whose blood is considerably warmer than the medium in which they live. The transition, however, is not abrupt. We have seen that some of the reptiles, especially the extinct forms, have avian tendencies. Among the birds, on the other hand, we shall see forms which have many reptilian features. In fact, the relationship existing between the reptiles and birds is closer than that between the reptiles and the forms with which, by the exigencies of publication, they are associated in this volume. By Huxley these two — Reptiles and Birds — are united in a group, Sauropsida.

HERMON C. BUMPUS.

INDEX.

- Aal-mutter, 103
 Abastor, 372
 Abeona, 240
 Aboma, 361
 Abramis, 123, 131
 Acanthoclinidae, 259
 Acanthocybium, 203
 Acanthodes, 92
 Acanthodini, 92
 Acanthopis, 384
 Acanthopteri, 99, 181
 Acanthopterygii, 181
 Acanthurus, 212
 Achirus, 280
 Acipenser, 93
 Acipenseridae, 92
 Acontias, 438
 Acremia, 2, 62
 Acris, 337
 Acrochordidae, 374
 Acrochordus, 374
 Adder, 391
 .. African puff, 392
 .. plumed, 392
 .. puffing, 394
 Adelfisch, 148
 Adjiger, 357
 Elurichthys, 119
 Etobatis, 89
 Agalychnis, 336, 339
 Agama, 411
 Agamidae, 411
 Aglossa, 318, 322
 Agriopodidae, 254
 Ahaetulla, 368
 Albula, 137
 Albulidae, 137
 Alburnus, 131
 Alepidosauridae, 138
 Alepidosaurus, 138
 Alepocephalidae, 138
 Alewife, 135
 Alfiona, 240
 Alice-shad, 136
 Alligator, 309, 422, 462
 All-mouth, 295
 Alopias, 80
 Alytes, 315, 329
 Ambassidae, 235
 Amber-fish, 190
 Ambloplites, 233
 Amblycephalus, 373
 Amblyopsidae, 172
 Amblyopsis, 172
 Amblyrhynchus, 416
 Amblystoma, 311
 Amblystomidae, 311
 Ameiva, 431
 Amia, 97
 Amiidae, 97
 Amiopsis, 98
 Amiurus, 117, 118
 Ammocetes, 67
 Ammocrypta, 230
 Ammodytes, 261
 Ammodytidae, 271
 Ammodytoidea, 261
 Ammiota, 52
 Amphibamus, 505
 Amphicebias, 466
 Amphignathodon, 339
 Amphignathodontidae, 339
 Amphioxus, 62
 Amphipnoidae, 100
 Amphispina, 433
 Amphisprenidae, 432
 Amphisilidae, 284
 Amphiuma, 308
 Amphiumidae, 308
 Amphiodus, 339
 Anyda, 446, 447
 Anabantidae, 242
 Anabas, 242
 Anableps, 171
 Anacanthini, 99, 267
 Anaconda, 361
 Anammia, 52
 Anarrhichas, 258
 Anarrhichthys, 259
 Anarrhichadidae, 257
 Anchovy, 134
 Ancistrodon, 394
 Anelytropidae, 440
 Angel-fish, 84, 210
 Angler, 293
 Anguinae, 425
 Anguilla, 101
 Anguillidae, 101
 Anguis, 425
 Aniella, 427
 Aniellidae, 427
 Anolis, 421
 Anomalepsis, 353
 Anopidae, 210
 Anoplopomidae, 253
 Anostominae, 133
 Antennariidae, 293
 Antennarius, 293
 Aura, 317
 Apeltes, 283
 Aploaspis, 402
 Apodes, 100
 Apogonidae, 235
 Aprasia, 411
 Arapaima, 142
 Archer-fish, 240
 Archoplites, 233
 Arcifera, 318, 326
 Argentina, 144
 Argentinidae, 144
 Arges, 114
 Argidae, 114
 Argyropelecus, 140
 Ariinae, 118
 Arius, 118
 Aromochelys, 452
 Ascidiaceae, 53
 Ascidiidae, 56
 Aspidonectes, 446
 Aspidotes, 359
 Aspredinidae, 112
 Aspredo, 113
 Asteroptyridae, 327
 Astrolepis, 92
 Astronesthes, 140, 141
 Astroscopus, 259
 Ateleopodidae, 261
 Atherina, 178
 Atherinidae, 178
 Atherinopsis, 178
 Anopidae, 139
 Anorthynchiidae, 283
 Aulostomidae, 284
 Auxis, 198
 Axolotl, 312
 Bachelor, 235
 Bagariinae, 119
 Bagarius, 121
 Bagrine, 115
 Bagrus, 116
 Balanoglossus, 61
 Balistidae, 287
 Barb, 215
 Barbel, 130
 Barber-fish, 211
 Barbus, 130
 Bar-fish, 234
 Barisia, 427
 Barracuda, 177
 Barramunda, 300
 Barrel-fish, 191
 Bascanium, 366
 Basiliscus, 413
 Basilisk, 410
 Bass, 215, 225
 .. black, 230, 249
 .. brass, 227
 .. calico, 234
 .. channel, 215
 .. grass, 234
 .. red, 215
 .. reef, 215
 .. rock, 233
 .. school, 215
 .. sea, 214, 215, 223
 .. spotted, 215
 .. strawberry, 234
 .. striped, 225, 226
 .. white, 226
 .. white sea, 214
 Bat-fish, 253, 296
 Bathylagus, 144
 Bathymasteridae, 247
 Bathytetrastis, 137
 Batrachia, 303
 Batrachian snakes, 305
 Batrachidae, 255
 Batrachoseps, 313
 Batrachus, 255
 Batrachyperus, 311
 Bay-eel, cloudy, 260
 Bdellostoma, 67
 Bellows-fish, 289
 Belodon, 464
 Belodontidae, 464
 Belone, 176
 Belonidae, 175

- Berg-lax, 275
 Berycidae, 182
 Beshow, 254
 Betta, 245
 Bichir, 95
 Bielaga, 93
 Big-head, 250
 Bill-fish, 97, 173, 203
 Black-bass, 230, 249
 Black-fish, 159, 173, 223, 238
 " rock, 223
 Black-horse, 132
 Black-snake, 365, 366, 382
 " mountain, 365
 Black-swallower, 247
 Blanquillo, 247
 Bleak, 131
 Bleekeria, 261
 Blenniidae, 257
 Blennioidea, 257
 Blind-fish, 172
 Blind-worm, 426
 Blinks, 193
 Blood-snacker, 411
 Blue-back, 136
 Blue-fin, 149
 Blue-fish, 182, 214, 239
 Blue-perch, 239
 Blue-pike, 228, 229
 Blue-sharks, 82
 Blunt-head, 373
 Boa, 359
 " dog-headed, 361
 " ringed, 361
 Boa constrictor, 360
 Boar-fish, 209
 Boecaco, 249
 Bodieron, 253
 Bogodidae, 235
 Boidea, 359
 Boltenia, 57
 Bolt, 236
 Bombinator, 329
 Bone-dog, 76
 Bone-fish, 137
 Bonito, 198
 " belted, 198
 Boom-slange, 368
 Borborocates, 321
 Boregat, 253
 Boregata, 253
 Borer, 67
 Bothrophera, 393
 Botryllidae, 58
 Botryllus, 58
 Bottle-fish, 289
 Bow-fin, 97
 Box-fish, 289
 Box-tortoise, 450
 " Blanding's, 450
 Brachycephalus, 340
 Brachymystax, 149
 Brachysoma, 384
 Bramidae, 207
 Branchiostoma, 62
 Bream, 129, 234
 " copper-nose, 234
 Breviceps, 339, 340
 Brevoortia, 136
 Brindle, 97
 Brontosaurus, 466
 Brook-trout, 165
 Bromophycis, 260
 Brotulidae, 260
 Brotulophidae, 261
 Brucephalus, 368
 Buffalo-fish, 132
 Bufo, 327
 Bufoidea, 319, 327
 Bull-frog, 341
 " North American, 341
 Bull-head, 116
 Bungarus, 381
 Bungarus, 381
 Burbot, 116, 273
 Burgall, 239
 Butter-fish, 191
 Cabezon, 250
 Caeopus, 340
 Caeciliidae, 305
 Calamaria, 362
 Calamariidae, 362
 Calamioichthys, 95
 Calamus, 222
 California toads, 424
 Callicheylus, 107
 Callichthyidae, 113
 Callichthys, 114
 Callionymidae, 257
 Callisaurus, 423
 Callophides, 384
 Calloopsis, 384
 Callorynchus, 72
 Calloselasma, 393
 Callula, 340
 Calophrynus, 340
 Calotes, 411
 Calyptocephalus, 331, 344
 Camarasaurus, 465
 Campbellite, 235
 Campostoma, 128
 Candle-fish, 145, 254
 " black, 254
 Capelin, 145
 Caproidae, 209
 Capros, 209
 Caracanthidae, 254
 Carangidae, 186
 Caranx, 187
 Carapax, 441
 Carawala, 393
 Careharias, 80
 Carcharinus, 82
 Carcharodon, 79
 Caret, 445
 Caribe, 134
 Carp, 126, 129
 " gold, 130
 " leather, 130
 " mirror, 130
 Carphophis, 362
 Carpiodes, 132
 Carrassius, 130
 Catadromos, 103
 Cat-fish, 110
 " blind, 117
 " channel, 118
 " electric, 119
 " gaff-topsail, 119
 " lake, 118
 " Mississippi, 118
 " sea, 118
 " small, 117
 Catostomidae, 131
 Catostomus, 132
 Caudisoma, 397
 Caularchus, 267
 Caulolatilus, 247
 Cavally, 186
 Cave-fishes, 172
 Cayman, 464
 " black, 464
 " Orinoco, 464
 Cebedichthyidae, 259
 Centrarchidae, 230
 Centriscidae, 284
 Centriscons, 284
 Centropomidae, 212
 Centropomus, 212
 Centropristis, 223
 Centrosyllium, 76
 Centrosymnus, 76
 Cephalacanthidae, 252
 Cephalacanthus, 253
 Cephalaspidae, 92
 Ceratiidae, 293
 Ceratodidae, 300
 Ceratodus, 300
 Ceratohyla, 339
 Ceratophrys, 326, 331, 332
 Cerdalidae, 261
 Cestracion, 78
 Cestracionidae, 78
 Cetorhinus, 79
 Chackla, 115
 Cheimonsida, 259
 Chetodipterus, 209
 Chatodon, 210
 Chetodontidae, 210
 Chetodontoidae, 209
 Chetostomus, 113
 Chamaeleontidae, 440
 Chamaesaurus, 426
 Chameleo, 440
 Chameleon, 421, 440
 " American, 420
 Chamida, 137
 Chamistes, 132
 Chanos, 137
 Characinae, 125, 132
 Charina, 355
 Charr, 164
 " Floeberg, 165
 " Greenland, 167
 " red, 150, 165
 Chatoeuss, 135
 Chaubodonotidae, 141
 Chaubodus, 140, 141
 Cheechea, 408
 Cheilorbina, 362
 Chelonia, 440, 445
 Chelonidae, 443
 Chelops, 149
 Chelydride, 455
 Chelydobatrachus, 328
 Chelydra, 452
 Chelydride, 452
 Chelys, 454, 456
 Chersydms, 375
 Chevreulins, 54
 Chiasmodon, 247
 Chiasmodontidae, 247
 Chilobrachyidae, 100
 Chilodipteridae, 235
 Chilomycterus, 290
 Chinacra, 71
 Chloglossa, 375
 Chiracanthus, 92
 Chiride, 253, 257
 Chirocentride, 134
 Chirocentrus, 134
 Chironantis, 341, 343
 Chirotas, 443
 Chitra, 447
 Chlamydosaurus, 412, 428
 Chlamydoselachide, 75
 Chlamydoselachus, 75
 Chologaster, 172
 Chondropterygii, 68
 Chondrostei, 92
 Chonerhinidae, 292
 Chordata, 2
 Chorophyllus, 330, 335, 338
 Christmas-fish, 279
 Chromididae, 235
 Chromis, 236
 Chromosms, 127
 Chrysomys, 448
 Chrysocela, 369
 Chub, 131
 " mackerel, 197
 " river, 129

- Chub, silver, 128
 Cichlidae, 235
 Cinosternidae, 452
 Cinosternum, 453
 Cirrihitidae, 248
 Cirrhosomus, 290
 Cisco, 149
 Cistudo, 451
 Citharinine, 133
 Clarias, 114
 Clariidae, 114
 Clepsydrops, 458
 Clidastes, 403
 Climbing-fish, 212
 Clinidae, 257
 Cloths, 382
 Clupea, 135
 Clupeidae, 135
 Cnemidophorus, 431
 Cobia, 212
 Cobitidae, 125
 Cobitis, 125
 Cobra, 376
 Cobra-da-capello, 376
 Cobra-monil, 392
 Cock-paddle, 251
 Cod, 268
 " bastard, 253
 " buffalo, 253
 " cultus, 253
 " green, 253
 " rock, 218, 253
 " tom, 273
 Codfish, 253
 Cœcilia, 318
 Cœciliidae, 317
 Cœlopeltis, 372
 Coleonyx, 410
 Coleophali, 101
 Colostethus, 340
 Colpocheilus, 446
 Coluber, 365
 Colubridæ, 365
 Colubritormia, 353
 Conger-eel, 105, 259
 Congers, 105
 Congo, 259
 Congridæ, 105
 Congrogadidae, 261
 Conodonts, 65
 Copelata, 56
 Copper-head, 394
 Coregonus, 147
 Coronella, 363
 Coronellidae, 363
 Coryphæna, 191
 Coryphanidae, 190
 Coryphanoides, 275
 Cottidae, 249
 Cottus, 250
 Crab-eater, 212
 Crania of anura, 320, 321
 Craniata, 2
 Cranopsis, 328
 Crappie, 235
 Crevalle, 187, 188
 Cricotus, 305
 Crocodile, 459
 " American, 462
 " black, 462
 " double-crested, 462
 " false, 462
 " Nile, 459
 " Orinoco, 462
 Crocodilia, 459
 Crocodilus, 459
 Crossopterygii, 95
 Crotalus, 367
 Crotaphytus, 423
 Cryptacanthodidae, 259
 Ctenodus, 91
 Ctenoids, 91
 Ctenoplatus, 239
 Ctenopterygius, 78
 Cubby-yew, 212
 Cultripes, 321, 331
 Cunner, 239
 Curimatinae, 133
 Cusk, 273
 Cutlass-fish, 206
 Cybium, 201
 Cycleptus, 132
 Cycloodus, 437
 Cycloids, 91
 Cyclomyaria, 59
 Cyclophis, 365
 Cyclopium, 114
 Cyclopteridae, 250
 Cyclopterus, 251
 Cyclostomata, 65
 Cyclostomi, 65
 Cyclura, 418
 " smooth-backed, 418
 Cylindrophis, 354
 Cymatogaster, 241
 Cynodon, 133
 Cynoscion, 213
 Cynthia, 57
 Cyprinidae, 125
 Cyprinodon, 171
 Cyprinodontidae, 171
 Cyprinus, 129
 Cystignathidae, 321, 329
 Cystignathus, 330
 Cyttidae, 208
 Dactylopteridae, 252
 Dactylopterus, 253
 Dactyloscopidae, 254
 Dallia, 174
 Dallidae, 173
 Damalichthys, 240
 Darter, 229
 " least, 230
 " sand, 230
 " striped, 230
 Dasybatus, 88
 Dasypterus, 373
 Day-light, 278
 Deal-fish, 265
 Death-adder, 384
 Delma, 411
 Dendraspis, 384
 Dendrobates, 339
 Dendrobatidae, 339
 Dendrophidae, 368
 Dendrophis, 368
 Dendrophryniscidae, 326, 329
 Denisonia, 384
 Desmognathidae, 314
 Desmognathus, 314, 329
 Desmomyaria, 60
 Devil-fish, 189
 Diabolichthys, 89
 Diadophis, 364
 Dihamidae, 440
 Dihanus, 440
 Dicentrarchus, 225
 Dicerolabis, 89
 Dicynodon, 458
 Didemnidae, 58
 Didocus, 321
 Diemenia, 379
 Diemycetylus, 316
 Dimorphodon, 468
 Dinematchthys, 260
 Dimichthys, 92
 Dinosauria, 464
 Diodon, 290
 Diodontidae, 290
 Diplacanthus, 92
 Diplodactylus, 409
 Diplodus, 221
 Dipneumonia, 300
 Dipnoi, 229
 Dipsadidae, 373
 Dipsas, 373
 Dipsosaurus, 422
 Dipterus, 95, 362
 Discocephali, 263
 Discoglossidae, 327, 329
 Discoglossus, 329
 Discophidae, 340
 Distichodon, 134
 Distichodontidae, 134
 Ditrema, 241
 Doctor, 211
 Dog-fish, 97
 " black, 76
 " bone, 76
 " picked, 76
 " skittle, 76
 " smooth, 82
 Doko, 391
 Doliolum, 60
 Dollardce, 234
 Dollar-fish, 188, 191
 Dolphin, 190
 Doradine, 119
 Doras, 119
 Dorosoma, 135
 Dorosomatidae, 134
 Dory, 208, 228
 Draco, 411
 Dragon, California, 423
 " flying, 411
 " Gabb's, 423
 " spotted-tailed, 423
 Drepanidae, 207
 Dromiscus, 267
 Drum, 215, 216
 " beardless, 214
 " branded, 214
 Drum-fish, 217
 Dryophila, 369
 Dryophis, 369
 Duck-bill cat, 94
 Dussmierinae, 136
 Dyscophidae, 339, 340
 Eagle-rays, 89
 Echeineidae, 263
 Echeineis, 264
 Eehidia, 382
 Echinorhinus, 75
 Echis, 382
 Eel, 101
 " conger, 105
 " electric, 124
 " pug-nose, 107
 " sand, 157, 261
 " sea, 105
 Eel-mother, 103
 Eel-pout, 229
 Egg-fish, 289
 Elachistodon, 373
 Elapidae, 376
 Elapides, 379
 Elaps, 379
 Elasnobranchii, 68
 Elasmosaurus, 458
 Elcate, 212
 Elcatidae, 212
 Electrophoridae, 124
 Electrophorus, 124
 Elopidae, 137
 Elops, 137
 Elosia, 321
 Embiotocidae, 239
 Embolomeri, 304, 305
 Emperor of Japan, 216
 Emydidae, 447
 Emys, 450

- Enchelycephali, 101
 Engraulididae, 134
 Engraulis, 134
 Engystoma, 340
 Engystomidae, 339, 340
 Emmeacanthus, 234
 Eperlan, 145
 Ephippidae, 209
 Epicarates, 361
 Epidalea, 328
 Epigonichthys, 64
 Epinephelus, 224
 Eques, 218
 Equulidae, 207
 Erumyzon, 132
 Erycidae, 355
 Eryops, 363
 Erythrina, 133
 Eryx, 355
 Esocidae, 168
 Esox, 169
 Etheostoma, 230
 Etheostominae, 229
 Eublepharidae, 409
 Eublepharis, 410
 Eugyra, 57
 Eulaeon, 145
 Eulamia, 73, 82
 Euleptorhamphus, 175
 Eumeces, 439
 Eumeces, 361
 Euprotomiscus, 76
 Eurypharynx, 109
 Eusophus, 321
 Eutania, 371
 Eventognathi, 125
 Exocoetidae, 173
 Exocoetinae, 175
 Exocoetus, 175
 Exoglossum, 128
 Exostoma, 113

 Fair-maid, 219
 Fall-fish, 128
 Famocentrata, 410
 Farancia, 372
 Fario, 151
 Fat-back, 179
 Fer-de-lance, 396
 Feuerkröte, 328
 Feylinia, 440
 Fierasferidae, 260
 Fighting-fish, 245
 Finnan Haddies, 271
 Firmisternia, 339
 Fishes, 90
 Fishing-frog, 177
 Fish of paradise, 245
 Fistularidae, 283
 Flat-fishes, 275
 Flying-fish, 173, 175, 253
 Fodiator, 175
 Fool-fish, 279
 Fork-beard, 273
 Frog, 317, 341
 " bull, 341
 " green, 343
 " wood, 342
 Frost-fish, 206
 Fundulus, 171

 Gadidae, 267
 Gadinae, 268
 Gadopsidae, 259
 Gadus, 268
 Galaxiidae, 143
 Galeichthys, 119
 Galeocerdo, 82
 Galeorhinidae, 81
 Galeorhinus, 82
 Galeus, 82

 Gambusia, 171
 Ganocephala, 304
 Ganoidea, 90
 Gar, 175
 " broad-nosed, 97
 Gar-fish, 175
 Garibaldi, 237
 Gar-pikes, 96
 Garrupa, 249
 Gasterosteidae, 280
 Gasterosteus, 283
 Gastrechia, 318, 339
 Gastrobranchus, 67
 Gastrostomus, 109
 Gavial, 459
 Gavialis, 459
 Geburtshelferkröte, 329
 Gecko, 406
 " flying, 409
 " variegated, 410
 " St. Lucas, 409
 " Xantus, 409
 Geckonidae, 406
 Genypterus, 260
 Geophagus, 236
 Geophis, 362
 Geotria, 57
 Geotriton, 314
 Gerrhonotus, 427
 Gerrhosauridae, 436
 Gerrhosaurus, 436
 Gila monster, 428
 Gillichthys, 257
 Ginglymodi, 56
 Glanenchell, 123
 Glanis, 115
 Glanostomi, 92, 93
 Glass-eye, 228
 Glass-snake, 427
 " Khasya, 434
 Globe-fish, 289
 Glossolega, 317
 Glyphoglossus, 340
 Gobiesox, 267
 Gobiesocidae, 267
 Gobio, 129, 131
 Gobioidae, 255
 Goggle-eyed-jack, 187
 Gogzler, 187
 Gold-fish, 130, 237
 Goniopholis, 464
 Goniosoma, 368
 Gonorhynchidae, 137
 Gonorhynchus, 137
 Gonostoma, 140
 Goodie, 215
 " Cape May, 215, 217
 Goose-fish, 177, 295
 Gopher, 453
 Gourami, 243
 Grammicolepididae, 207
 Grande écaille, 137
 Grayling, 150
 " American, 151
 " common, 151
 Gray-pike, 151
 Green-cod, 253
 Green-fish, 183
 Grilse, 160
 Grindle, 97
 Gronias, 117
 Ground-snake, 362
 " Australian, 363
 Grouper, 224
 " red, 224
 Grunt, 218
 Grypiscus, 321
 Grystes, 230
 Guaicau, 264
 Guana, 415
 Guana, 224

 Gudgeon, 129, 131
 Gular, 349
 Gurnard, 252
 Gymnarchidae, 121
 Gymnarchus, 121
 Gymnodontes, 289
 Gymnognathus, 123
 Gymnophiona, 317
 Gymnotidae, 124
 Gyropleurus, 78

 Haddock, 270
 Hadrosaurus, 465
 Hamulon, 218
 Hamuloidae, 218
 Hag-fish, 67
 Hair-tails, 206
 Hake, 274
 " Old England, 275
 " silver, 275
 Hake's dame, 273
 Halecomorphi, 97
 Halibut, 276
 Hållfisk, 276
 Hållfiskundra, 276
 Halosauridae, 142
 Halosaurus, 142
 Hammer-head, 80
 Haplochiton, 143
 Haplochromidae, 143
 Haplochromis, 217
 Haploni, 168
 Hard-tail, 188
 Harpagiferidae, 247
 Harvest-fish, 191
 Hatteria, 456
 Helicops, 372
 Heleiporus, 330
 Hell-bender, 309
 Heloderma, 428
 Helodermatidae, 428
 Helicetes, 237
 Hemibranchii, 280
 Hemichromis, 243
 Hemiodactylus, 408
 Hemilepidotus, 249
 Hemiphractidae, 327, 339
 Hemiramphina, 174
 Hemiramphus, 174
 Hemisalamandra, 315
 Hemisida, 339
 Hemisus, 339
 Hemitriptera, 254
 Heniochus, 210
 Hen-paddle, 251
 Heptanchus, 74
 Heros, 237
 Herpetodryas, 325
 Herpeton, 369, 372
 Herring, 135
 " branch, 135
 " gut, 137
 " lake, 149
 " Ohio, 135
 " toothed, 138

 Heterandria, 171
 Heterodon, 364
 Heterodontus, 78
 Heterosomata, 275
 Heterotis, 143
 Heterostichus, 257
 Hexagrammus, 253
 Hexanchidae, 74
 Hexanchus, 74
 Hiattula, 238
 Hippopagrus, 223
 Hippocampidae, 285
 Hippocampus, 285
 Hippoglossus, 270
 Histiobranchus, 108
 Histioporidae, 203

- Histiopherns, 203
 Histiurus, 413
 Hoe, 76
 Hog-choker, 280
 Hog-fish, 229
 Holacanthus, 239
 Holbrookia, 424
 Holconotidae, 239
 Holocentridae, 181
 Holecenrus, 182
 Holocephali, 71
 Hologerrhum, 374
 Holostei, 97
 Holostomi, 100
 Homalopsidae, 372
 Homalopteridae, 125
 Hoplichthyidae, 254
 Hoplocephalus, 381, 382
 Hoplopleuridae, 142
 Horn-fish, 229
 Horned-pout, 116
 Horned-toads, 425
 Horny-head, 129
 Horse-fish, 183
 Horse-head, 183
 Hound, 82
 Huachu, 163
 Hucho, 163
 Hundfisch, 170
 Huro, 230
 Huso, 93
 Hydraspis, 456
 Hydrocyon, 133
 Hydrocyoninae, 133
 Hydrophidae, 384
 Hyla, 335, 337
 Hylambates, 341
 Hylella, 337
 Hylidae, 327, 333, 337
 Hylodes, 322, 330
 Hynobius, 311
 Hyodon, 138
 Hydodontidae, 137
 Hyperoartia, 65
 Hyperolapedon, 457
 Hyperolius, 341
 Hyperotretia, 67
 Hynnale, 393
 Hypomesus, 146
 Hypopachus, 340
 Hypophthalmidae, 112, 120
 Hypostomides, 262
 Hypsiboas, 333, 336, 339
 Hysirulina, 372
 Hysifario, 153
 Hysypops, 237
 Hysterocardus, 241

 Ichthyborinae, 134
 Ichthycephali, 100
 Ichthyodolurites, 65
 Ichthyomyzon, 67
 Ichthyopterygia, 457
 Ichthyosauri, 457
 Ichthyosaurus, 457
 Icesteidae, 247
 Ictalurinae, 116
 Ictalurus, 118
 Ictobius, 132
 Id, 131
 Idus, 131
 Iguana, 415, 418
 " horned, 415
 " naked-necked, 415
 Iguanidae, 414
 Iguanodon, 465
 Inconnu, 149
 Ipuopidae, 137
 Ipuops, 139
 Isistius, 76
 Isospondyli, 134

 Isurus, 79
 Ixalus, 341

 Jacare, 464
 Jack, 186, 249
 Jack-salmon, 228
 Jew-fish, 224
 'John A. Grindie,' 97
 'John Dory,' 208, 249
 Jordanelia, 171

 Kettle-maw, 295
 Killifishes, 171
 King-fish, 72, 178, 215
 King of the herrings, 207
 Kneria, 125
 Kneridae, 125
 Komtok, 301
 Kowalevskia, 56
 Kurtidae, 207

 Labidesthes, 173
 Labridae, 225
 Labrax, 225
 Labridae, 238
 Labrine, 238
 Labrus, 238
 Labyrinthodon, 305
 Lacerta, 434
 Lacertidae, 433
 Lacertilia, 405
 Lady-fish, 137
 Laelaps, 466
 Lamargidae, 75
 Lafayette, 215, 217
 Lagocephalus, 290
 Lagodon, 222
 Lamna, 79
 Lammidae, 79
 Lamper-eel, 259
 Lampetra, 65
 Lampreys, 66
 Lamprididae, 207
 Lampris, 207
 Langya, 181
 Lant, 261
 Latilidae, 246
 Latilus, 247
 Latris, 248
 Launce, 261
 " sand, 261
 Lavaret, 148
 Lawyer, 97
 Leather jacket, 288
 Lederkarpfen, 130
 Lepidomeda, 129
 Lepidopididae, 206
 Lepidopleurini, 94
 Lepidopus, 206
 Lepidosiren, 300
 Lepidosteidae, 96
 Lepidosteus, 96
 Lepidotidae, 96
 Lepomis, 233
 Leptocardi, 62
 Leptocephalus, 106
 Leptodactylus, 330
 Leptognathus, 373
 Leptophis, 368
 Leptops, 117
 Leptoscopidae, 254
 Letharchus, 107
 Leuciscus, 131
 Liasis, 359
 Ling, 212, 260
 Liodon, 404
 Lioplepis, 414
 Liopelma, 329
 Lirus, 191
 Lithodytes, 330

 Litholepis, 96
 Living-fish, 181
 Lizard, 407
 " alderman, 423
 " croaking, 409
 " frilled, 412
 " Galapagos, 416
 " gray, 434
 " green, 435
 " ground, 431, 438, 439
 " Holbrook's, 424
 " many-keeled, 427
 " Oregon, 427
 " pine, 422
 " safeguard, 431
 " sail, 413
 " sand, 434
 " scaly, 434
 " six-lined, 431
 " spine-tailed, 418
 " striped, 431
 " tuberculated, 415
 " variegated, 431
 " water, 429
 Lizard-fish, 139
 Loaches, 125
 Loche, 273
 Log-fish, 191
 Loggerhead, 444
 Loke-Sild, 149
 Longe, 167
 Look-down, 188
 Lophidae, 293
 Lophius, 177, 294
 Lophobranchii, 285
 Lopholatilus, 246
 Lophopsetta, 278
 Loricaria, 113
 Loricaridae, 113
 Loricati, 248
 Losh, 273
 Lota, 116, 273
 Lotinae, 273
 Lucie, 59
 Lucifuga, 260
 Luciopeca, 228
 Lump-fish, 250
 Lump-sucker, 251
 Lung-fishes, 299
 Lutjanidae, 292
 Lutjanus, 292
 Luvaridae, 207
 Lycodidae, 259
 Lycodon, 374
 Lycodontidae, 374
 Lyomeri, 109

 Mackerel, 191
 " big-eyed, 197
 " bull, 197
 " chub, 199
 " easter, 197
 " frigate, 197
 " horse, 183, 190
 " snapping, 183, 199
 " Spanish, 201
 " tinker, 197
 " yellow, 183
 Macrolechys, 452
 Macropodus, 245
 Macrorhamphidae, 284
 Macrorhamphus, 284
 Macruridae, 275
 Macrurus, 275
 Madregal, 190
 Maenidae, 235
 Maigre, 214
 Malacanthidae, 247
 Malacoclemmys, 448
 Malacosteus, 141
 Malapterurinae, 119

- Malapterurus, 119
 Mallotus, 145
 Maltie, 296
 Manculus, 313
 Manta, 89
 Marbled Polychrus, 415
 Marsbanker, 187
 Marsipobranchiata, 65
 Massasanga, 397
 Mastacembelidae, 110, 259
 Matheidia, 296
 Maurolicus, 140
 Meagre, 214
 Meda, 129
 Megera, 293
 Megelobatrachus, 308, 311
 Megalops, 137
 Melanogrammus, 270
 Melanophidium, 354
 Menhaden, 136
 Menidae, 267
 Menidia, 178
 Menobranchius, 307
 Menticirrhus, 215
 Merlangus, 272
 Merlucciidae, 274
 Merluccius, 275
 Meron, 249
 Mesogonistius, 234
 Metapoceros, 417
 Micristodus, 79
 Microgadus, 273
 Microhya, 340
 Microperca, 229, 230
 Micropterus, 230
 Microstoma, 144
 Miller's-thumb, 250
 Minnilus, 127
 Minnow, 127, 131, 170
 " mud, 170
 " top, 171
 Misgurnus, 126
 Moccasin, highland, 394
 " water, 395
 Mola, 291, 292
 Molacanthus, 292
 Molge, 315
 Molgophis, 305
 Molgula, 57
 Molidae, 291
 Molliesia, 171
 Moloch, 414
 Molva, 273
 Monacidae, 56
 Monitor, 430
 " water, 431
 Monk-fish, 84, 295
 Monocentridae, 182
 Monopneumonia, 300
 Monopteridae, 100
 Moon-eye, 137
 Moon-fish, 188
 Mordacia, 67
 Morelia, 359
 Moringua, 108
 Moringuide, 107
 Mormyridae, 121
 Mormyrus, 121
 Morone, 226
 Mosasaurus, 404
 Mossbunker, 136
 Moxostoma, 132
 Mud-eel, 308
 Mud-fish, 97
 Mugil, 103, 179
 Mugilidae, 178
 Mullet, 178
 " big-eyed, 178
 " jumping, 178
 " sand, 178
 " silver, 178
- Mullidae, 245
 Mullus, 245
 Mummichog, 179
 " blue-fish, 179
 Muraena, 107
 Muraenidae, 107
 Muraenopsis, 308
 Murry, 107
 Muskallunge, 169
 Mustela, 81
 Mutton-fish, 259
 Myctophum, 139, 140
 Myliobatidae, 83
 Myliobatis, 89
 Myrichthys, 107
 Myxine, 67
 Myxiniidae, 67
 Myxocyprinus, 182
 Naja, 369, 376, 377
 Nako, 459
 Nannocharacinae, 133
 Narcacoin, 87
 Narcea, 87
 Nardoa, 459
 Natriidae, 369
 Naucleus, 190
 Naucrates, 189
 Necturus, 305
 Nemachilus, 126
 Nematistidae, 207
 Nematogenyinae, 120
 Nematognathi, 110
 Nemichthyidae, 108
 Nemichthys, 108
 Nemophidiidae, 257
 Nessia, 438
 New-light, 235
 Nipper, 239
 Norway-haddock, 249
 Notacanthidae, 110
 Noteus, 98
 Notemigonus, 129
 Notidanidae, 74
 Nototheniidae, 247
 Nototrema, 322, 337
 Notropis, 127
 Noturus, 117
 Oar-fish, 266
 Odacidae, 239
 Odontaspis, 80
 Oedipus, 314
 Oestoecephalus, 305
 Oikopleura, 56
 Oligodon, 362
 Oligosoma, 438
 Ombre chevalier, 165
 Oncorhynchus, 151
 Opah, 207
 Opheosaurus, 427
 Ophibolus, 364
 Ophichthyidae, 107
 Ophichthys, 107
 Ophidia, 348
 Ophidiidae, 260
 Ophidioidae, 261
 Ophidiobolus, 347
 Ophioccephalidae, 180
 Ophioccephalus, 181
 Ophiodes, 427
 Ophiodon, 253
 Ophiophagus, 378
 Ophisnerus, 107
 Opisthodelphys, 322, 337
 Opisthognathidae, 247
 Opisthomi, 110, 116
 Opisthonema, 136
 Opoterodonta, 352
 Oryzias, 198
 Ornithosauria, 477
- Orthogoriscidae, 291
 Orthodon, 127
 Orthopristis, 218
 Orvet, 426
 Osmerus, 144
 Osphromenidae, 243
 Osphromenus, 243
 Osseter, 93
 Osteoglossidae, 142
 Osteoglossum, 142
 Osteophygis, 446
 Ostracintidae, 288
 Ostracodermi, 288
 Otaspis, 329
 Otsego-bass, 148
 Oudenodon, 458
 Oxudercidae, 257
 Oxybelis, 368
 Oxyglossus, 344
 Oxyrhopus, 374
 Paddle-fish, 94
 Pagrus, 219
 Palaenobatrachus, 329
 Palaeniscus, 96
 Paludicola, 323
 Panai feri, 243
 Pantodon, 142
 Pantodontidae, 142
 Pantosteus, 132
 Paradise-fish, 245
 Pareas, 374
 Paralepididae, 139
 Paralichthys, 278
 Parr, 159
 Parrot-fish, 239
 Passerita, 369
 Patacida, 239
 Pediculati, 292
 Pegasidae, 262
 Pelias, 391
 Pelican-fish, 109
 Peliosauria, 458
 Pelobatidae, 321
 Pelomedusa, 456
 Pelomedusidae, 456
 Peltaphryne, 328
 Peltopel, 333
 Pemptheridae, 297
 Pentacerotidae, 210
 Perca, 228
 Percesoces, 176
 Perch, 227, 240
 " blue, 239
 " log, 229
 " pike, 228
 " red, 237, 249
 " river, 241
 " sea, 239
 " trout, 168
 " white, 227
 " yellow, 227
 Percidae, 227
 Percina, 229
 Percoidea, 213
 Percomorphi, 121
 Percophidiidae, 247
 Percopsidae, 168
 Percopsis, 168
 Periophthalmus, 257
 Peristidiinae, 252
 Perophora, 57
 Pesce rey, 178
 Petromyzon, 65
 Phaneropteron, 302
 Pharyngognathi, 99, 235
 Philodryas, 368
 Phlegethonia, 305
 Phosphorescent fishes, 139
 Phoxinus, 131
 Phractosomata, 92

- Phryniscidae, 340
 Phryniscus, 340
 Phrynocephalus, 413
 Phrynomantis, 340
 Phrynomantis, 340
 Phrynosoma, 424
 Phrynotitan, 255
 Phycinae, 273
 Phycis, 273
 Phyllodactylus, 409
 Phyllomelasma, 336, 339
 Phyllopteryx, 286
 Physostomus, 99
 Pickrel, 169
 Pig-fish, 218
 Pike, 168, 169
 " blue, 228, 229
 " gray, 229
 " Sacramento, 131
 " sand, 229
 " wall-eyed, 228
 " yellow, 228
 Pilchard, 136
 Pilot-fish, 248, 289
 Pimelopteridae, 235
 Pimelodinae, 118
 Pin-fish, 222
 Pipa, 322
 Pipe-fish, 285
 Pipidae, 322
 Pisces, 90
 Pityophis, 367
 Placodermi, 92
 Placoids, 91
 Plagiodus, 138
 Plagiotomus, 72
 Plalce, 278
 Plakat, 245
 Placidae, 210
 Platurus, 376
 Platycephalidae, 274
 Platydictylus, 407
 Platypteridae, 257
 Platysaurus, 426
 Platysonidae, 95
 Platystacus, 112
 Plectoglossus, 149
 Plectognathi, 286
 Plectospondyli, 125
 Plecturus, 354
 Plesiosaurs, 458
 Plesiosaurus, 458
 Plethodon, 313
 Plethodontidae, 313
 Pleurodeles, 316
 Pleurodelidae, 316
 Pleurodira, 456
 Pleurolepidae, 95
 Pleuronectes, 278
 Pleuronectidae, 276
 Plosidae, 115
 Pseudomyx, 455
 Pseudonius, 216
 Poisson rouge, 215
 Pollachius, 271
 Pollock, 271
 Polychrus, 415
 Polyclinidae, 58
 Polynemidae, 263
 Polynemus, 263
 Polyodon, 94
 Polyodontidae, 94
 Polypedates, 344
 Polypteridae, 95
 Polypterus, 95
 Pomacentridae, 237
 Pomatomidae, 183
 Pomatomus, 183
 Pomoxys, 234
 Pompano, 188, 191
 Porbeagles, 79
 Pore des rivières, 241
 Porcupine-fish, 290
 Porcus, 116
 Forge, 210, 219, 222, 210
 Poronotus, 191
 Potamotrygon, 89
 Potter, 448
 Pout, eel, 111, 273
 " horned, 116
 Preadilla, 114
 Prendemeys, 448
 Pride, 67
 Prionotus, 252
 Pristida, 85
 Pristiphoridae, 78
 Pristiphorus, 78
 Pristiponidae, 218
 Pristis, 85
 Promicrops, 224
 Propleuridae, 446
 Prostraphis, 340
 Proteida, 305
 Proteida, 305
 Proteroglypha, 376
 Proterosaurus, 457
 Proteus, 305
 Protonopsidae, 308
 Protonopsis, 308
 Protoperus, 301
 Protostega, 443
 Protostegidae, 443
 Prototroctes, 143
 Psammophidae, 372
 Psammophis, 372
 Psammophylax, 364
 Psephurus, 94
 Psetta, 278
 Psetta, 210
 Pseudocheneis, 113
 Pseudoechis, 383
 Pseudemys, 448
 Psendis, 339, 331
 Pseudobranchius, 306
 Pseudochromididae, 247
 Pseudonaja, 379
 Pseudophryne, 328
 Pseudopus, 433
 Pseudotropis, 121
 Psilodactylus, 410
 Psilonotidae, 290
 Pteranodon, 468
 Pterichthidae, 92
 Pterodactylus, 468
 Ptilichthyidae, 259
 Ptilichthys, 259
 Ptychochilus, 129, 131
 Ptychozoon, 409
 Ptyonius, 305
 Puffer, 289
 Pumpkin-seeds, 233
 Pycnodontidae, 95
 Pycnodontini, 94
 Pycnopodidae, 411
 Pycopus, 411
 Pygosteus, 283
 Pyrosoma, 59
 Pyrosomidae, 59
 Pythonidae, 356
 Pythonomorpha, 402
 Pythons, 356
 Pytonius, 305
 Rabbit-fish, 290
 Racer, 365
 Rachiodon, 373
 Rachiodontidae, 373
 Raia, 87
 Raia, 84
 Raialae, 87
 Rana, 341
 Ranidae, 319, 340
 Ranidens, 311
 Ranula, 344
 Rattler, 400
 " diamond, 400
 " horned, 402
 " water, 401
 Rattlesnake, 397
 " banded, 401
 " black, 397
 " ground, 397
 " Oregon, 399
 " prairie, 399
 " red, 402
 " western black, 399
 Ray, 84
 Red-bass, 215
 Red-eye, 131
 Red-fin, 127
 Red-fish, 152, 159, 214, 218, 249
 Red-horse, 132, 215
 Red-lead, 193
 Reef-bass, 215
 Regalecidae, 266
 Regalecus, 266
 Reinhardtius, 278
 Remora, 265
 Reptiles, 345
 Reptilia, 345
 Rerias, 393
 Retropinna, 144
 Rhachitoni, 304, 305
 Rhacochilus, 240
 Rhacophorus, 341
 Rhamphorhynchus, 468
 Rhegnopteri, 262
 Rhina, 84
 Rhineura, 433
 Rhinichthys, 127
 Rhinobatidae, 85
 Rhinobatus, 85
 Rhinodon, 78
 Rhinodontidae, 78
 Rhinoglaninae, 229
 Rhinophis, 354
 Rhinophrynus, 327
 Rhinoptera, 89
 Rhinotriacis, 82
 Rhynehodus, 72
 Rhyncocephalia, 450
 Rhyncosaurus, 457
 Rhypticidae, 224
 Rhypticus, 225
 Ribbon-fish, 265
 River-jack, 392
 River-perch, 241
 River-trout, 161
 Roach, 131
 Rohalo, 212
 Robin, 252
 " flying, 253
 " sea, 252
 Roccida, 225
 Roccus, 225
 Rock-bass, 233
 Rock-cod, 248, 253
 Rock-fish, 225
 " brown, 249
 " red, 240
 Rock-snake, Natal, 358
 " royal, 358
 Rock-trout, 253
 Rose-fish, 249
 Rothfisch, 163
 Round-fish, 148
 Roussettes, 83
 Rudder-fish, 190, 191
 Sabalo, 137
 Sabre-fish, 206
 Saccopharyngidae, 110
 Sail-fish, 203

Salamander, American, 329
 " spotted, 313
 Salamandra, 315
 Salamandrella, 311
 Salamandridae, 315
 Salangidae, 143
 Salar, 158
 Salarias, 257
 Sällbing, 165
 Salmo, 158
 Salmon, 151, 158, 228
 " blue-back, 152
 " dog, 153
 " fall, 156
 " hump-back, 153
 " king, 152
 " land-locked, 161
 " lost, 158
 " Mackenzie River, 149
 " quinnat, 152
 " silver, 153
 " spring, 156
 Salmonidae, 146
 Salmon-trout, 159, 161
 Salpa, 60, 250
 Saluth, 115
 Salvellinus, 150, 164
 Sand-piper, 67
 Sarda, 198
 Sardinade España, 136
 Sardine, 136
 Sanger, 229
 Sauranodon, 457
 Saurornis, 423
 Sauropleura, 305
 Sauropterygia, 453
 Saw-fishes, 85
 Scabbard-fish, 206
 Scad, 186
 " big-eyed, 187
 Scaphiopus, 333
 Scaphirhynchops, 94
 Scardinius, 131
 Scaridae, 239
 Scaro, 239
 Scaurus, 239
 Scatophagidae, 210
 Scelidosaurus, 465
 Sceloporus, 421
 Schnaps-sticker, 364
 Schnäpel, 147
 Scirpa, 214
 Scienidae, 213
 Scincidae, 436
 Scincus, 437
 Sclerodermi, 187
 Sclerognathus, 132
 Scomber, 192
 Scomberosoma, 173
 Scomberosox, 174
 Scomberomorus, 201
 Scombridae, 191
 Scombroidea, 182
 Scoodlo, 271
 Scopelidae, 139
 Scopæna, 249
 Scorpanichthys, 249
 Scorpenidae, 248
 Scorpene, 249
 Scorpion, 249, 250
 " brown, 422
 Sculpin, 249, 250
 Scup, 219
 Scuppaug, 219
 Seyllidae, 83
 Scyllium, 83
 Scymnidae, 75
 Scymnus, 76
 Scyphophori, 121
 Scytale, 374
 Scytalidae, 374

Scytopsis, 321, 339
 Sea-bass, 214, 215, 223
 Sea-cat, 72
 Sea-devil, 89
 Sea-horse, 285
 Sea-owl, 251
 Sea-peach, 57
 Sea-pear, 57
 Sea-perch, 239
 Sea-pork, 58
 Sea-purse, 85
 Sea-rat, 72
 Sea-raven, 254
 Sea-serpent, 75, 266
 Sea-snakes, 384
 Sea-squirts, 56
 Sea-trout, 224, 253
 Sea-turtles, 444
 Sebastes, 249
 Sebastichthys, 249
 Sebastodes, 249
 Selache, 79
 Selachii, 68, 72
 Selachostomi, 92, 94
 Selene, 188
 Semotilus, 128
 Seps, 437
 Sergeant-fish, 212
 Seriola, 190
 Serpents, 348
 Serranidae, 223
 Serranus, 223
 Serrasalmo, 133
 Serrasalmoninas, 134
 Sewin, 161
 Shad, 135
 " allice, 136
 " American, 136
 " gizzard, 134
 " hickory, 135
 " tlwaite, 136
 Shad-waiter, 148
 Shark, angel, 84
 " basking, 79
 " bonnet, 81
 " cat, 83
 " cow, 74
 " dog, 82
 " dusky, 82
 " gray, 80
 " ground, 76
 " gurry, 76
 " hammer-head, 80
 " hound, 82
 " mackerel, 79
 " man-eater, 79, 83
 " oil, 74, 82
 " Port Jackson, 78
 " sand, 80
 " shovel-head, 81
 " shovel-nose, 80
 " sleeper, 76
 " spinous, 75
 " swell, 83
 " swingle-tail, 80
 " thrasher, 80
 " tiger, 82, 83
 " whale, 75
 " white, 82
 " zebra, 83
 Shark-barrrows, 85
 Sheat-fish, 115
 Sheephead, 217, 220
 Shield-tails, 354
 Shiner, 127
 " blunt-nosed, 188
 " golden, 129
 Shovel-nose, 80
 Side-winder, 402
 Siganidae, 212
 Sillaginidae, 247

Siluridae, 115
 Silurinae, 115
 Silurus, 115
 Silver-eel, 207
 Silver-sides, 178
 Silybura, 354
 Simenchelyidae, 107
 Simenchelys, 107
 Simotes, 362
 Siponognathidae, 239
 Siranota, 316
 Siren, 306
 Sirenidae, 200, 306
 Siscowet, 168
 Sisoridae, 113
 Skate, barn-door, 88
 " brier, 88
 " smooth, 89
 " tobacco-box, 88
 Skates, 24
 Skink, 436, 437
 " Bermuda, 439
 " blue-tailed, 439
 " official, 437
 " Skilton's, 440
 Skipjack, 135, 183, 207
 Skipper, 173
 Skittle dog, 76
 Skulljoe, 271
 Smelt, 144, 178
 " European, 145
 " surf, 146
 Smolt, 159
 Snake, Æsculapias, 366
 " black, 366, 382
 " black and white ringed, 384
 " broad-headed, 382
 " bull, 347
 " carpet, 359
 " chain, 364
 " chicken, 366
 " coach-whip, 366
 " collared, 364
 " coral, 380
 " corn, 365
 " desert, 372
 " diamond, 359, 382
 " dwarf, 362
 " emperor, 359
 " fox, 366
 " fresh-water, 372
 " garter, 371
 " glass, 427
 " gopher, 367
 " grass, 370
 " gray, 367, 379
 " green, 365
 " ground, 362
 " harlequin, 380
 " hog-nosed, 364
 " hoop, 372
 " horn, 372
 " house, 364
 " indigo, 367
 " king, 367
 " milk, 364
 " orange-bellied, 382
 " pine, 367
 " rat, 367
 " ring, 364
 " ringed, 370
 " rock, 358
 " sand, 355
 " scarlet-spotted, 384
 " sea, 384
 " shield-tail, 354
 " short-tailed, 354
 " spectacle, 377
 " spotted-necked, 371
 " striped, 371

- Snake, thunder, 362
 " tree, 368
 " wart, 374
 " worm, 162
 Snakes, 348
 Snapper, 452
 " gray, 222
 " mangrove, 222
 " Pensacola, 222
 " red, 222
 Snappers, 183
 Snipe-fish, 108, 284
 Snook, 212
 Soap-fish, 225
 Sole, 279
 Sola, 279
 Soleidae, 279
 Solenoglypha, 376
 Solenostoma, 285
 Solenostomi, 285
 Solenostomidae, 285
 Somniosus, 76
 Spade-foots, 333
 Spanish-mackerel, 201, 254
 Sparidae, 218
 Sparisoma, 239
 Sparus, 218
 Spatularia, 94
 Spea, 332
 Spear-fish, 203
 Sclerpes, 314
 Spharodactylus, 408
 Sphargida, 443
 Sphargis, 443
 Sphenodon, 546
 Sphenophryne, 340
 Sphryna, 81
 Sphrynide, 80
 Sphryna, 177
 Sphrynidae, 177
 Spiegelskarpfen, 130
 Spikes, 163
 Spilotes, 367
 Spinachia, 283
 Spinacidae, 76
 Spook, 72
 Spoon-bill cat, 94
 Spot, 215, 217
 Sprat, 136, 240
 Spurge-schlang, 377
 Squall, 72
 Squalius, 129, 131
 Squalorala, 78
 Squalus, 76
 Squatina, 84
 Squatinidae, 84
 Squeteague, 213
 Squirrel-fish, 181
 Star-gazer, 254
 Starling, 253
 Steel-head, 162
 Stegocephali, 304, 305
 Stegophilinae, 120
 Stegostoma, 83
 Stellio, 414
 Stenodus, 149
 Stenorhina, 362
 Stenostoma, 353
 Stenotomus, 219
 Stephanoberycidae, 182
 Stereocyclops, 340
 Sterlet, 93
 Sternopychidae, 141
 Sternopygidae, 125
 Sternotheridae, 456
 Sterolepis, 224
 Stichidae, 259
 Sticklebacks, 280
 Sting-bull, 254
 Sting-fish, 254
 Sting-rays, 88
 Stizostedion, 228
 Stoasodon, 89
 Stolephorus, 134
 Stomias, 140
 Stomatidae, 140
 Stone roller, 128
 Storeria, 371
 Stromateidae, 191
 Stromateus, 191
 Surgeon, 42
 " green, 93
 " lake, 93
 Stygiola, 260
 Stygoenes, 114
 Stylophoridae, 267
 Stylophorus, 226
 Sucker, 132, 263
 " carp, 132
 " hare-lip, 132
 " Missouri, 132
 Suck-fish, 263
 Sucking-fish, 263
 Sudis, 131
 Surf-fish, 240
 " black, 241
 Sun-fish, 233, 291
 " blue, 234
 " long-eared, 234
 Surgeon, 211
 Swell-fish, 289
 Swell-toad, 289
 Swift, 422
 Swingle-tail, 80
 Sword-fish, 203, 207
 Symbranchia, 100
 Symbranchidae, 100
 Synanceidae, 254
 Synaphobranchidae, 108
 Synaphobranchus, 108
 Synascidae, 57
 Syneutognathi, 173
 Syngnathi, 285
 Syngnathidae, 285
 Synodontis, 119
 Synodontidae, 139
 Synodus, 139
 Tadpoles, 327, 343
 Tanioid, 206
 Taniotom, 265
 Tailor, 183
 Tantilla, 362
 Tapetum, 38
 Taranto, 407
 Tarpon, 137
 Tantog, 238
 Tantoga, 238
 Teiidae, 431
 Teius, 431
 Teleocephali, 121
 Teleosaurus, 464
 Teleostei, 98
 Telmatobius, 331
 Temnodon, 183
 Tench, 131
 Tenpounder, 127
 Terrapin, 448
 " geographical, 448
 " red-bellied, 448
 " salt-water, 448
 " yellow-bellied, 448
 Testudinidae, 453
 Testudo, 453
 Tetragonopterina, 133
 Tetragonopterus, 133
 Tetragonuridae, 207
 Tetragonurus, 207
 Tetrapterus, 203
 Tetradon, 200
 Tetradontidae, 289
 Teuthidae, 211
 Teuthidoidae, 211
 Teuthis, 211
 Thalassochelys, 444
 Thalassophryne, 255
 Thaleichthys, 145
 Thaliacea, 59
 Thecadactylus, 409
 Theronomorpha, 457
 Thoracosaurus, 464
 Thorius, 314, 315
 Thoropa, 321
 Thread-fish, 206
 Thread-worm, 433
 Thymallus, 150
 Ticpolonga, 392
 Tilapia, 236
 Tile-fish, 246
 Tinca, 131
 Tinkers, 193
 Toad, 327
 " hermit spade-foot, 333
 " natterjack, 328
 " obstetrical, 329
 " spade, 333
 " spade-foot, 333
 " Surinam, 323
 " tree, 335
 Toad, development of, 4
 Toad-fish, 255
 Toads, 318, 327
 Tobacco-box, 88
 Tobacco-pipe fish, 283
 Togue, 139
 Tom-cod, 273
 Tomistoma, 459
 Tope, 82
 Torpedo, 85
 Torpedinidae, 85
 Tortricidae, 354
 Tortrix, 354
 Tortoise, box, 450
 " horse, 449
 " Indian, 454
 " land, 454
 " mud, 453
 " river, 449, 455
 " sculptured, 449
 " wood, 449
 " yellow, 452
 Toxotidae, 210
 Trabu, 136
 Trachinidae, 254
 Trachinus, 254
 Trachurops, 187
 Trachurus, 186
 Trachycephalus, 321, 335
 Trachynotus, 188
 Trachypteridae, 265
 Trachypterus, 265
 Trachysaurus, 435
 Trachystomata, 306
 Tragos, 369
 Tragycephalus, 335
 Tree-frog, 337
 Tree-toads, 335
 Triacanthidae, 287
 Trichiuridae, 206
 Trichiurus, 206
 Trichiodon, 291
 Trichodontidae, 254
 Trichomycteridae, 120
 Trigger-fish, 288
 Trigla, 252
 Trigle, 252
 Triglinia, 252
 Trigonoccephalus, 396
 Trimeresurus, 393
 Triodontidae, 289
 Trionychidae, 446
 Tripriion, 335, 339
 Triton, 316

- Tropedechis, 383
 Tropidolepis, 421
 Tropidonotus, 370, 383
 Trout, 158
 " black spotted, 161
 " brook, 165
 " Dolly Varden, 167
 " great lake, 167
 " lake, 161
 " Mackinaw, 167
 " rainbow, 162
 " Rangeley lake, 165
 " red-throated, 163
 " Rio Grande, 163
 " river, 161
 " rock, 253
 " salmon, 159, 161,
 " sea, 159, 161, 214
 " steel-head, 162
 Trumpeter, 248
 Trunk-fish, 289
 Trygon, 88
 Trygonidae, 88
 Tuditanus, 305
 Tullibee, 149
 Tunicata, 53
 Tunicates, 2
 Tunny, 198
 Turbot, 278, 288
 Turtle, 440
 " alligator, 452
 " bastard, 446
 " bearded, 454, 456
 " fimbriated, 456
 " fresh-water, 447
 " Greek, 454
 " green, 445
 " hawk-bill, 445
 " land, 454
 " leather-back, 442, 443
 " leathery, 443
 " loggerhead, 444
 " marine, 440
 " mud, 453
 " musk, 452
 " Oregon, 449
 " painted, 448
 " snapping, 452
 " soft-shelled, 446
 " speckled, 449
 " trunk-back, 443
 Turtle, plates of, 443
 Tylosurus, 176
 Tylostotriton, 317
 Typhlethys, 172
 Typhline, 440
 Typhlonectes, 318
 Typhlopidae, 352
 Typhlops, 352
 Ular Sawad, 357
 Uma, 422
 Umbra, 170
 Umbridae, 170
 Umbrina, 215
 Unke, 329
 Uranidea, 250
 Uranoscopidae, 254
 Urochorda, 2
 Urodela, 307
 Urogymnus, 89
 Urolophus, 89
 Uropeltidae, 354
 Uropeltis, 354
 Uroplates, 110
 Uroplatidae, 410
 Uta, 422
 " Stanbury's, 422
 Vaagmer, 261
 Vampyrus, 89
 Varanidae, 429
 Varanus, 429
 Vendace, 149
 Vermicella, 384
 Vertebrata, 1
 Vertebrates,
 air-bladder of, 44
 auditory organs of, 35
 blood of, 46
 bones of, 16, 17, 18, 19, 23, 24, 25
 brain of, 32
 description of, 3
 development of eggs of, 4
 eggs of, 3, 4
 embryo of, 5, 6
 epidermal appendages of the
 skin in, 9
 eye of, 37
 gills of, 43
 glands of, 8, 9, 38, 41, 46
 heart of, 48
 intestinal system of, 40
 lungs of, 45
 lymph of, 50
 muscular system of, 26
 nervous system of, 27
 notochord in, 11
 olfactory organ of, 39
 origin of organs in, 4, 5, 6
 respiratory organs of, 43
 ribs of, 13
 scales of, 10
 sexes of, 3
 skeletal structures of, 9
 skeleton of limbs of, 21
 skin in, 7
 skull of, 14
 sternum of, 13
 teeth of, 10
 thymus gland of, 45
 thyroid gland of, 46
 urogenital system of, 51
 vascular system of, 46
 visceral skeleton of, 20
 Viper, 391
 " Indian, 392
 Vipera, 391
 Virginia, 362
 Vomer, 188
 Walking-fish, 181
 Warsaw, 224
 Water-dog, 309
 Water-pig, 244
 Weak-fish, 213
 " spotted, 215
 Weever, 254
 " greater, 254
 " lesser, 254
 Weissfelsen, 148
 Weissfisch, 148
 Wels, 115
 Welshman, 181
 Whitebait, 144
 White-fish, 147, 183, 247
 " common, 148
 " lake, 147
 " Menominee, 148
 " mongrel, 149
 " Musquaw River, 149
 " Rocky Mountain,
 148
 Whiting, 215, 272, 275
 " lake, 149
 " New England, 275
 Wide-gap, 295
 Wide-gut, 295
 Window-pane, 278
 Wing-fish, 252
 Wolf-eel, 259
 Wolf-fish, 258
 Woodcock-fish, 284
 Wrass, 238
 Xantusia, 431
 Xantusidae, 431
 Xenelaphis, 368
 Xenobatrachus, 340
 Xenocephalidae, 261
 Xenodermus, 376
 Xenomi, 173
 Xenopeltis, 354
 Xenopodidae, 322, 326
 Xenopterygii, 267
 Xenopus, 326
 Xenosauridae, 426
 Xenosaurus, 426
 Xiphidiiontidae, 259
 Xiphidae, 203
 Xiphiphorus, 171
 Xiphosoma, 361
 Yellow-tail, 247
 Zamenis, 368
 Zamelidae, 210
 Zenarchopterus, 174
 Zenidia, 208
 Zenopsis, 203
 Zeus, 208
 Zoarcidae, 259
 Zoarces, 103, 251, 259
 Zonuridae, 426
 Zonurus, 426
 Zootoca, 435
 Zygenia, 81
 Zygonecetes, 171

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